SIXTY-EIGHTH YEAR

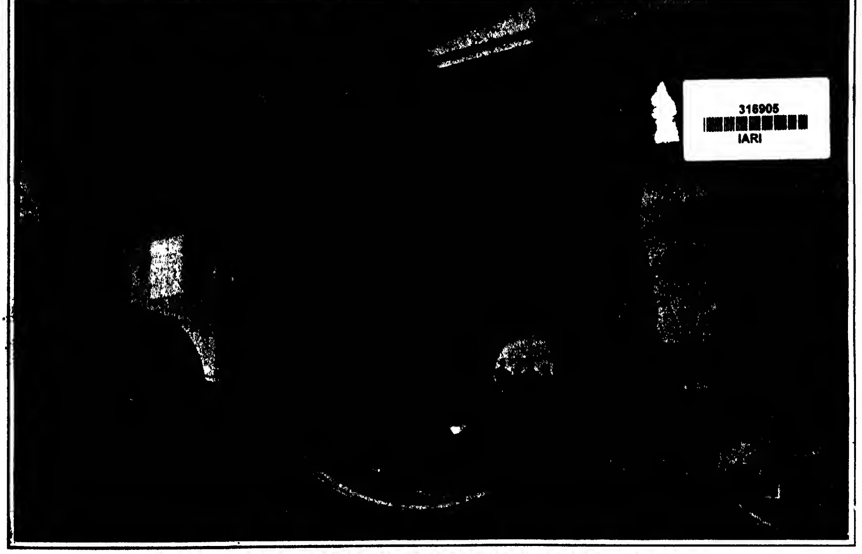
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII.
NUMBER 1.

NEW YORK, JULY 6, 1912

10 CENTS A COPY
$3.00 A YEAR



The rotor contains fifty thousand blades. The casing is eighteen feet diameter and twenty-five feet long.

THE LOW-PRESSURE TURBINE OF THE "IMPERATOR."—[See page 5.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 6, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba and Panama	
Subscriptions for Foreign Countries one year, postage prepaid,	4.50
Subscriptions for Canada one year, postage prepaid, ...	3.75

The Scientific American Publications

Scientific American (established 1845) . . . . per year,	$3.00
Scientific American Supplement (established 1876) . "	5.00
American Homes and Gardens . . . . "	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

High Speed Through the Ice Fields

THE Board of Trade inquiry into the loss of the "Titanic," which is being held under Lord Mersey, naturally is eliciting more detailed evidence than it was possible to gather during the necessarily limited investigation by our Senate Committee. Thus far, some very startling testimony has been given (startling at least to the lay mind) by certain of the more important witnesses. Mr. Ismay, for instance, gave an unqualified endorsement of the course followed by Capt. Smith, of the "Titanic," in proceeding at full speed after he had received several warnings that there was heavy ice ahead of the ship. The witness made the point that, by traveling at high speed, the "Titanic" would have been sooner through the zone of danger and out in clear water again. The argument is familiar. We have heard the same thing said in justification of traveling at high speed through a belt of fog.

So important is this testimony in the light which it throws on the risks of transatlantic travel, that we have made personal inquiry among the navigating officers of several first-class passenger ships, and we find that if the weather is clear, it is the universal practice not to slow down the ship, even though it be well known, through wireless despatches, that there is a field of ice ahead. "We never stop for ice in clear weather," said one officer of an English ship. "The course followed by Capt. Smith was perfectly justified," was the comment of the leading officer on one of the fastest German ships. Indeed, the consensus of this expert opinion, without an exception, justified the high speed of the "Titanic," as being in accordance with the recognized practice under such conditions on the bridge of all transatlantic steamships. It seems to be universally held that, if a good lookout is kept on such a clear night as that of April 14th, it is practically impossible to avoid seeing an iceberg, long before it gets into dangerous proximity to the ship. Obviously, then, one of the lessons of this disaster is that now and again, even though the night be clear, there will occur conditions, such as a smooth sea and an iceberg of a color that approximates to the general coloring of the sea, which may make it impossible to detect the ice in time to avoid collision, and so may render a repetition of the "Titanic" disaster inevitable.

It would seem from testimony given before the Board of Trade that conditions did render it extremely difficult to see this particular iceberg. One officer of the "Titanic" testified "everything was against us," meaning that the size of the iceberg, its color and the absence of broken water at its base, made it practically impossible to detect the obstruction until it was close aboard.

In our investigation, above referred to, we found a consensus of opinion, also, that the chances of avoiding the ice when it was once sighted were as good, if not better, when the ship was running at high speed than when she was running under a slow bell; it being claimed that the ship would answer her helm more quickly at high than she would at low speed; which is undoubtedly true.

Now, since the steamship companies wish their ships to be run at full speed, if possible, all the way across the Atlantic; since the officers in command of the ships are unanimously in favor of high speed; and since the public, except when it is in a panic over some portentous disaster, is certainly in favor of high speed; it is safe to assume that speed will not be slackened in the future, either in fog or among icebergs. Ships weighing from 40,000 to 70,000 tons will continue to go hurtling their way across the Atlantic, whether by night or by day, trusting to the sharp eye and the steady hand to avert disaster. Evidently, if travel is to be made absolutely safe, that is to say, if the "Titanics" of the future are not occasionally to be sent to the bottom at short warning, carrying a multitude of people with them, something should be done to make the ship unsinkable under those special conditions when "everything is against" the ship and the keen eye and the steady hand are not sufficient to prevent catastrophe.

The Board of Trade inquiry now going on in London will fail pitifully of its purpose, if it does not make such changes in the laws governing the structural requirements for safety in future ships as shall make them practically unsinkable by collision, whether with another ship, as in the case of the "Republic," or with ice, as in the case of the "Titanic," or with the derelict, as in the case of many a good ship that has sailed and never been heard of again.

Battle Efficiency and Navy Appropriations

THE reluctance of the House of Representatives to provide the necessary appropriations to carry out the very reasonable program for maintaining our Navy at its proper relative strength, looks like a very poor recognition of the high state of efficiency to which our existing fleets have been carried.

There may be other departments of the Government which can show an equal rate of improvement; but we are certain that there are none which can excel the record which has been made during the past two or three years by our Navy Department.

At the last analysis, the object of the money which has been spent and the infinite care, thought, patience, and hard work, which have so markedly characterized every branch of the Navy Department, is the maintenance on the high seas of a fleet of battleships and cruisers, characterized by the highest efficiency, and at all times ready for immediate action at the call of the Government.

Everyone who is at all familiar with conditions in the Navy to-day knows that this efficiency has been realized beyond the most sanguine expectations. Not only are the latest battleships which have gone into commission among the most powerful and most completely protected in the world, but the efficiency of these ships, as shown in target practice under battle conditions, is such as to warrant the belief that our gunners lead the world in the accuracy and rapidity of their fire at the longest ranges.

The fighting efficiency of our battleships of to-day, as compared with that of the fleet which fought under Sampson and Schley during the Spanish-American war, shows an improvement which is scarcely believable except by those who, like the writer, have had an opportunity to witness the work of the fleet from one of the battleships engaged. This improvement has been succinctly stated by Mr. Meyer, the Secretary of the Navy, more than once during the past few months. A comparison shows that, whereas the percentage of hits in 1898 was 3½ with the large guns, firing about once in five minutes at short range, the percentage of hits in the firing last year at the San Marcos was 33 1/3, the range being 10,000 yards, and the present rate of firing a single 12-inch gun being about ten shots in five minutes. This rather overestimates the work at Santiago and underestimates the work to-day. A roughly drawn comparison shows that we are about 1,200 times better in gunnery efficiency than we were at Santiago.

So far then as the ability of our battleships and cruisers to hit the enemy hard and often at great ranges is concerned, it is certain, if we may adopt a current phrase, that the country is "getting its money's worth." If the pruning knife of economy must be used, it would be wise, surely, to spare a tree which is yielding such abundant fruit.

A New Method of Testing Coal

AS a test of the value and character of fuel, the discovery of the amount of volatile matter in coal is unquestionably of the very greatest importance. This is estimated by finding the loss in weight of about fifteen grains of a sample, by bringing it to a high temperature in a platinum dish. This simple procedure really gives more information than any detailed chemical or calorimetric analysis.

However, the complete accuracy of the test is not always possible. The weight, length, breadth, and intensity of the flame and the heat, as well as the platinum receptacle which holds the sample, the sort of gas and burner, the distance, time, and other conditions, all have some effect upon the results, that is upon the residue left and the volatile matter driven off.

The committee on coal analysis of the American Chemical Society over twelve years ago made an exhaustive study of [illegible] in a report that the method [illegible] the amount of volatile [illegible] uniform plan to follow.

Usually the coke left behind is [illegible] ignored. The caking or swelling of the [illegible] mentioned, but no discussion of the kind [illegible] of the coal enters into consideration.

Dr. R. Lessing has just announced to the London Society of Chemical Industry a novel [illegible] plan, which will give a more correct [illegible] difference in the coke produced from various [illegible] which will account for the process of carbonization in all cases. It will show a qualitative distinction between the various types of coal, and eliminate the failings of the old method, the platinum dish test.

The sources of error in the old method may be said to be, first, elements which raised the volatile value, such as combustion of coke in the air rich in oxygen, and flickering coal dust due to the explosive gases of certain coals and rush of air currents caused by the flames. Secondly, the elements that decrease the volatile value, such as cessation of the action before the coal is thoroughly coked, deposit of the volatile materials on the walls of the platinum crucible, and decomposition of volatile substances by radiation.

The secondary breaking up of volatile substances, depends on the breadth of surface with which they come in contact. The coal in the platinum crucible is spread in a very thin layer. It takes up less than one tenth of the whole space. The gas and tar vapors touch a broader area than is good. In order to avoid the errors caused by waste space over the coal, and too much heated surface in contact with the gas and other volatile products in the crucible test, Dr. Lessing prefers to conduct his analysis with a small cylindrical vessel. He applies the heat to the coal itself, and not to the volatile products. By introducing a piston which rests on the powdered coal and fits loosely into the outer cylinder, all waste space is prevented, and all gases and vapors are allowed free play.

Dr. Lessing's apparatus consists of a heating tube, a quartz glass cylinder. This non-conducting medium may have an electric resistance coil of platinum wire wound directly around it. Numerous glass pin points are fused on this tube to keep the turns of the platinum coil apart. In order to concentrate the heat where it is required, the platinum wire is first wound to a close coil and this is wound around the cylinder tube. The coil attaches itself by its own elasticity. The coils are close at the bottom of the cylinder, getting wider and wider apart, so that the heat is just enough to keep the coal tar volatilized. Another "reacting" glass vessel fits loosely into the other "heating" tube. Its interval diameter is about one third of an inch.

Fifteen grains of the powdered coal are placed in the inner tube, and into a third tube which telescopes into the other inner tube. By altering the weight of this innermost tube or filling it with different amounts of quartz powder, during the test various pressures may be exerted on the coal.

The outermost tube is buried in an insulating substance such as kieselguhr. A rheostat combined with the furnace allows various changes of resistance and the temperature may be accordingly altered.

The test is made, by weighing the coal into the middle tube. Then the innermost tube is inserted over this and the two placed within the outside, insulated tube. As the current is turned into the platinum coil, the temperature slowly rises, allowing the gradations and steps of carbonization to be recorded. First, free moisture, then occluded gases, soon to be followed by tarry vapors, will be seen increasing in volume. All this depends upon the kind of coal tested. The heavier liquid tars and pitches condense on the cold parts of the innermost tube. The whole test requires about six minutes, and is then permitted to cool. The coke obtained shows the character of the coal.

Dr. Lessing's simple device also serves to identify the individual differences of each kind of coal. Any particular kind of coal will give at all times when treated under the same conditions, a coke identical in all respects with another specimen produced from the same sample.

"Although the principal consideration in designing the apparatus," says Dr. Lessing, "is to obtain a means for generally studying bituminous coals as fuel, satisfactory results have been obtained when employing it for a quantitative estimation of volatile matter."

Limits of Natural Vision.—The limits of vision vary with elevation, condition of the atmosphere, intensity of illumination and other modifying elements in different cases. On a clear day an object one foot above a level plain may be seen at the distance of 1.31 mile, one [illegible] feet high [illegible] miles, one 20 feet high [illegible] miles, one 100 feet high [illegible] miles; one a mile high, as the top of a mountain, [illegible] miles. This allows [illegible] inches for the curvature of the earth, and assumes that the size and illumination of the object are sufficient to produce an image [illegible].

[illegible]

[illegible] it is reported that [illegible] of starch are irradiated for several hours [illegible] of moderate penetrative power, the starch is [illegible] converted into soluble starch and dextrin, and [illegible] and viscosity of the solution are markedly [illegible]. An exposure of 5½ hours caused the transformation of about 5 per cent of the starch into dextrin.

The Montefiore Prize.—The conditions for the triennial Montefiore prize for the 1914 concourse are the following: The prize consisting of 3 per cent interest upon a Belgian fund of \$30,000, will be awarded every three years to the best original work presented upon scientific advancement and the progress made in technical applications of electricity in all departments, excluding popular treatises or simple compilations. This award is known as the George Montefiore Levi prize, and the jury is formed of ten electrical engineers, five home and five foreign, presided over by the chief professor of the Montefiore electro-technical institute. The last date for receiving contributions for the concourse is March 31st, 1914, and further information can be obtained from the secretary of the Montefiore association at Liege, Belgium, 31 rue Saint-Gilles.

Accuracy of Electric Meters Under Intermittent Loads.—Certain critical consumers of electrical energy who have noted that their electric meters keep on running for one or two seconds after the lights are turned out or the elevator or other motor is shut down, may have imagined that their meters were overcharging them by this action. These persons can have their fears allayed by the conclusions of a paper on "Electrical Meters under Variable Loads," recently read before the British Institution of Electrical Engineers, viz., that errors due to intermittent loads are relatively small in meters of the type generally used in the United States, designed with the Foucault braking disk. The fact is liable to be overlooked that the inertia of the meter, which causes the latter to run for a moment after the current is interrupted, will also tend to prevent the meter from starting for a moment after the circuit is closed.

Electricity from Peat.—European engineers are engaged at present in the investigation of methods of utilizing peat as fuel in electric stations. Southern Bavaria, for instance, has vast peat fields which would serve to run electric plants of large size and this would give a great reserve of power. The peat bogs lie mainly in the region of the Danube, and are estimated to cover an area of 500 square miles. Supposing the peat layer to be only 3 feet in thickness and the cubic foot of peat to afford but 3 pounds of fuel, this will mean a supply of 50 million tons. With the operation of extracting the peat regularly carried on during the year for 309 days, this can afford 700,000 horse-power in the space of 50 years. The fuel can be burned under boilers or it can be used in special producers to secure a supply of gas for industrial purposes.

Hydro-electric Plants in Iceland.—Iceland possesses a large amount of power in the shape of waterfalls, and for some time past the question of obtaining an electrical supply from them has been under consideration, but what makes the matter difficult is that most of the falls lie at great distances from the coast and are far from the centers of population. There are however many other falls which could be utilized. Quite recently a French syndicate purchased a large extent of ground in the neighborhood of Thorlakshaven, as well as several large waterfalls situated in the mountain regions in the interior. It is stated that the falls will be able to furnish as much as 200,000 horse-power. The present syndicate is to construct a good port upon its ground and it will furnish a supply of current to different industries which are situated in this district. One of the newest enterprises will be the construction of works for manufacturing nitrogenous products on the Birkeland-Eyde electric system.

Electric Light Service in Denmark.—According to recent information about the progress of electric light and power industries in Denmark, it appears that all the towns of 5,000 inhabitants and over are now provided with public electric service. As to towns lying between 5,000 and 3,000 inhabitants, there are only three in which electric mains are not installed, so that it will be seen that Denmark is one of the most progressive countries in this respect. The largest sized electric stations are to be found at Copenhagen, and at present there are three large plants in operation giving a total of 27,000 horse-power. Current is supplied for the city mains as well as for the tramway lines. As regards the Danish stations in small towns, in general each town has its own plant, and there is but one example of an interconnected system. This is at Skovshoved, near Copenhagen, and the [illegible] station extends its power lines over all the [illegible] also supplying the tramways of Hellerup and [illegible]. In most of the town electric stations the [illegible] is used.

Science

A Russian North Polar Expedition is being planned by Capt. Sedow, who has had considerable experience in exploring under Arctic conditions, having led an expedition to the mouth of the Kolyma in 1909, and one to Nova Zembla in 1910. Sedow proposes to proceed in a ship to Franz Josef Land, and thence to attempt a sledge journey over the ice to Greenland, by way of the pole. He has announced his intention of naming any land he may find near the pole "Nicholas II Land," and thus counts on securing the patriotic support of the Russians to his undertaking. There has been some talk in the Russian Duma of providing the explorer with a government vessel, to be especially constructed for ice-crushing, in accordance with an old plan of the late Admiral Makaroff.

The Australasian Antarctic Expedition, under Dr. Mawson, has not only proved the existence, over a distance of some 1,200 miles, of Wilkes Land, which has been a bone of contention between American and European geographers for seventy-odd years, but has actually landed two parties on it; one, under Mawson himself, nearly at the east end of this coast, at Point Alden, in the eastern part of Adelie Land; the other, under Mr. Wild, about 1,200 miles farther west, in the part of the coast that was named by Wilkes Termination Land, and that has hitherto been either ignored or marked with a note of interrogation on all European maps. The landing of Mr. Wild's party was accomplished with great difficulty, on the precipitous ice-cliff of a glacier about 100 feet high. A year's stores had to be hoisted to the top by means of shear-legs. Besides these two parties in Antarctica, the expedition landed five men at Macquarie Island, where a wireless telegraph station was installed. The "Aurora," the ship of the expedition, finally sailed back to civilization, and will return to relieve the exploring parties in the southern summer of 1912-13. Meantime, she will carry on oceanographic research—for which she is specially equipped—to the south of Australia.

Sea Routes to Siberia.—Contrary to previous reports, it now appears that the plans of the English captain, Webster, to establish regular steamship communication between European ports and northwestern Siberia by way of the Arctic Ocean and Kara Sea have been disapproved by the Russian government, obviously for the reason that this bold undertaking, which appeared to be entirely feasible, would have diverted considerable traffic from the trans-Siberian railway. On the other hand, the Russian authorities are furthering in every way the establishment of communication by sea between Pacific ports and northwestern Siberia, *via* Bering Strait. A surveying party, under Capt. Grünfeld, has proceeded from Yakutsk to Nishni Kolymsk, at the mouth of the Kolyma River, to make a thorough investigation of that port, and the geologist, J. P. Tolmatschew, will study the conditions of navigation between the mouths of the Kolyma and the Lena, including an examination of the Lena delta, with a view to establishing a sea route to the latter region. The ice-breakers "Taimyr" and "Waigatsch" were to leave Vladivostok in May for a surveying expedition along the coast of Kamtchatka, after which they will proceed *via* Bering Strait to the Arctic coast of Siberia for a cruise at least as far west as the Lena. If ice conditions prove favorable these vessels will attempt to pass Cape Chelyuskin and accomplish the northeast passage to the European port of Archangel.

An Elixir of Life.—At a recent meeting of the French Academy of Sciences, Prof. Metchnikoff, Director of the Pasteur Institute, gave a fascinating account of another advance in his struggle against the factors causing senility. Recent scientific research has shown the natural decay of the human body to be brought about by the bacterial flora of the intestines. The fact that the Bulgarian peasants feeding partly on yoghurt, a fermented product of cow milk, reach an astounding longevity, is accounted for by the invasion of beneficent bacteria taking the place of the harmful inhabitants of our digestive organs. Arteriosclerosis, sclerosis of the liver and an inflammation of the kidneys are the three maladies produced according to Metchnikoff by the poisonous action of our bacteria. Experiments on animals have shown the two toxins *indol* and *phenol*, which are responsible for this poisoning of the body, to be eliminated by food rich in sugar, such as dates, bananas, etc., the sugar destroying the poison. As, however, the sugar, being absorbed in the upper parts of the intestines, does not penetrate as far as the large intestine, which contains these dangerous toxins, means had to be designed for introducing sugar into that part of the alimentary canal. Such a means has now been found in a beneficent microbe derived from the bacterial flora of dogs and which, especially if assisted by an abundant consumption of potatoes and by some lactic ferment, will prevent the production of toxin. These experiments, in Prof. Metchnikoff's own words, are the first step toward the conversion of our bacterial vegetation from a "wild" flora into a cultivated harmless flora.

Aeronautics

The Death of Harry Turner.—Harry Turner, a nineteen-year-old mechanic in the employ of an aviator in Mineola, was killed recently in his employer's machine. He was making a circle above the field when he attempted to descend. It is not very clear how the accident occurred. Apparently it was due to bad handling.

The First Navy Zeppelin.—The German navy is to have its first Zeppelin airship. Hitherto, the rigid dirigibles of Count Zeppelin have been used by the army and by a private company for the transportation of passengers. In its official tests, the navy Zeppelin will be required to remain aloft continuously for twenty hours and to carry one ton of explosives. Most of the Zeppelins are now equipped with wireless apparatus.

A Parachute Drop from an Aeroplane.—The first successful parachute drop from a flying machine was made on Long Island by a venturesome young man named Law, who has been startling the residents of New York by leaping from tall buildings, in a parachute. Law went up with an aviator in a biplane. The parachute was attached to the under side of the lower plane. While the accounts that have been given of the exploit are not very clear, it seems that Law crawled under the plane hand over hand until he managed to seize the parachute.

Some Recent German Aviation Exploits.—It is curious that we hear so little in this country of some of the more remarkable achievements of German aviators. How many people in this country know of the recent flight from Berlin to Vienna by Hirth with a passenger, in which a mountain range 4,500 feet high was crossed and in which an average speed of more than sixty miles an hour was maintained? It may interest those readers of the SCIENTIFIC AMERICAN who have been following our articles on the GOULD-SCIENTIFIC AMERICAN Prize that the machine was equipped with two motors and two propellers.

Aviation Insurance.—According to United States Consul General A. M. Thackara of Berlin, the business of insuring the limbs and lives of aviators is not very prosperous in Germany. The rate for the insurance of those who go up in balloons and dirigibles has recently been increased, while insurance for those who go up in aeroplanes is simply unobtainable. "None of the local companies will now quote rates for the insurance of aviators against death. The rates for accident insurance for aviators are \$2.38 for a \$238 policy and \$1.76 for a policy *yielding* a daily remuneration of twenty-four cents during invalidity. The rates for the insurance of aviators against liability for damages arising from injury to other persons range from \$29.75 for a policy paying a maximum of \$5,950 when one person is injured or \$17,850 when more than one is injured, to \$47.60 for a maximum of \$23,800 for one or \$71,400 for more than one person injured. The rate for insurance against liability for damages to property is 20 per cent of the policy when damages from fire or explosion are not included and 30 per cent when such damages are included. The minimum premium is \$2.38 and the maximum liability \$2,380. The rules governing this form of insurance are in general the same as those usually covering other forms of insurance against liability for damages. Insurance against accident of those who go up in motorless balloons as in the case of aeroplane accident insurance is usually written in connection with ordinary accident insurance. The rates for this combined insurance are the same as for ordinary accident insurance plus the rate quoted above."

The Naval Aeroplane.—In a book entitled "Aviation in the Navy," Lieut. E. Lapointe of the French navy discusses the relative merits of the hydro-aeroplane and of the aeroplane which starts from and alights on the deck of a battleship. He points out that the hydro-aeroplane is not favored by sailors because it is useful only in absolutely still water. To alight on the water, he argues, is no great advantage except perhaps for a great aeroplane acting independently of a ship and attempting to make a protracted cruise. He proposes that a competition be held for a naval aeroplane which, by means of special floats, watertight bodies, or even fixed wings serving as floats, has the ability to float on a moderate sea and in a moderate breeze for several hours without injury to passengers or machinery. The motor must be of such construction that, after several hours in this position, it can be overhauled and put in operation in a few minutes. It must be possible to hoist the machine from the water and land it on a ship's deck by the ship's crane. It must be able to start from or land upon the shore under ordinary conditions. Lieut. Lapointe distinguishes between an aeroplane scout to carry two passengers, a pilot and an observer, for three hours with an extra weight of 100 pounds, giving a total weight carried of 400 pounds, exclusive of necessary oil and gasoline for the motor, and an aeroplane cruiser which shall carry three passengers, a pilot, a mechanic and an observer, for at least five hours, with an extra load of 200 pounds, giving a total weight carried of 670 pounds, exclusive of necessary oil and gasoline for the motor.

The 11-inch howitzer is hauled by motor cars.

A New Type of Powerful Mortar

The Krupp Eleven-inch Howitzer and Portable Carriage

By the English Correspondent of the Scientific American

OWING to the development that has taken place in the design and construction of protective works in connection with fortifications, where ever-increasing strength is secured to the point almost of invulnerability, there has been a demand for more powerful and heavier weapons of attack. There is no doubt but that in the next war between any two of the foremost powers, greater stress will be laid upon the artillery. The war between Russia and Japan emphasized this factor to a convincing degree when, although the Japanese brought the latest skill in military science to bear upon Port Arthur, they made but little impression with their fire upon the permanent works. This attack was remarkable for the fact that in the attack the Japanese employed the heaviest arm that has ever been directed against fortifications—a 28-centimeter or 11-inch mortar.

In Russia, Austria-Hungary and France weapons of this type of 23, 24, and 27 centimeters, respectively, are in service, but in every instance they are practically permanent defense pieces, demanding a solid firing platform. Accordingly, if the occasion arises for the arm to be removed from one point to another, the operation is one of great difficulty and occupies considerable time.

Realizing this deficiency in mobility, the Krupp firm has designed a new type of mortar of this character, the outstanding feature of which is that it is mounted upon a gun carriage, so that it can be moved from point to point, and can even be attached to the artillery in field operations. This end is achieved without any sacrifice of ballistic efficiency, by the application of a long invariable recoil, and by the employment of wheels fitted with feet after the manner of the Diplock pedrail.

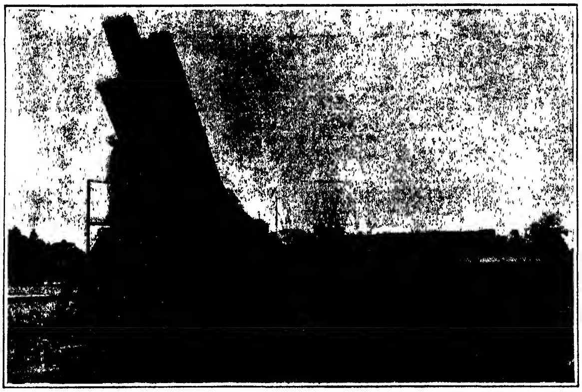
The Krupp designation of this piece as a howitzer is to distinguish it from the mortar proper, reserving the latter title for those weapons able to fire at an angle exceeding 45 degrees. This new arm has a greater variation in its elevation, so that it really is more flexible in use. The two terms however are now so generally confounded that it may be classed as a mortar.

The barrel is made of steel and comprises the inner bore and a jacket, the total length being 11 feet. The opening and closing of the breech is effected by turning a handle through a horizontal arc for about 135 degrees, and there is a safety device operated by hand to prevent premature firing or the accidental opening of the breech. After the discharge, the spent cartridge is automatically ejected by the opening of the breech block. Owing to the principle of construction, the opening and closing of the breech can be effected easily by one hand and in a few seconds, notwithstanding that it weighs over 1,100 pounds.

The carriage upon which the arm is mounted comprises in reality two vehicles. The barrel or mortar proper is carried upon one carriage, while the other carries the mounting with the recoil brake and the two air reservoirs. In transport the two pieces are hauled separately, the main wheels of each carriage being shod with feet, so as to permit passage over soft ground without sinking, while haulage is carried out by gasoline motor cars, as being more suited to the work than horses. Upon arriving at the position of firing, the mounting carriage is planted first, and then the second carriage is moved up from the rear, until the bore is in line with the cradle of the mounting. By means of thin wire cables and pulleys the mortar is pulled from its own carriage, and slides over special guides through the opening in the second carriage, until it is in the designed position, where it is made fast and connected up. The second carriage is then withdrawn, leaving the arm complete upon the mounting carriage and ready for firing.

The training gear gives a maximum elevation to the mortar of 65 degrees and works upon a rapid system. The weapon can also be moved 5 degrees on either side in the horizontal plane. The upper part of the cradle into which the bore slides carries a group of three cylinders. The central cylinder is the recoil brake, while that on either side is an air reservoir. The recoil brake differs from the type adopted in connection with field guns. The gun is not connected to the brake cylinders but to the piston rod. Consequently, it is the piston rod and the piston which move in the recoil of the gun, the brake cylinder remaining stationary. The air reservoirs consist essentially of an air cylinder, a ram with piston rod and piston, and valves.

The howitzer fires a shell weighing 136 pounds, and the charging of the weapon requires the aid of six or eight men, the explosive charge weighing 38 pounds. By using one of eight different charges, it is possible to vary the initial velocity from 590 to 1,115 feet per second. It is possible to secure, with all distances exceeding 7,218 feet a falling angle for the shell exceeding 22 degrees. The weight of the projectile is more than twice that of the next most powerful weapon of its class, while its range is 20 per cent higher.



The mortar being transferred from its transport cradle to the mounting.

Bore, 11 inches, length, 11 feet, shell, 136 pounds, powder, 38 pounds, maximum elevation, 65 degrees; maximum range at 65 degrees 24,278 feet, maximum range at 42½ degrees, 33,185 feet.

A mobile 11-inch mortar for field service.

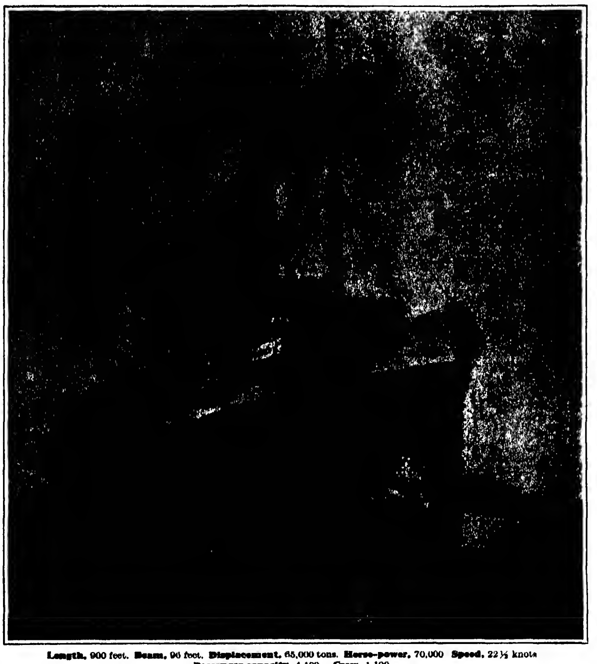
The Largest Ship Yet Constructed

The Launch of the 65,000 Ton Liner "Imperator"

WITH the loss of the "Titanic" fresh in the public mind, special interest attaches to the recent launch of the "Imperator," which exceeds that huge vessel by some 5,000 tons. The ship is being built for the Hamburg-American Company at the Vulcan Yard at Hamburg, and the ceremony of naming the ship at the launching was performed by the Kaiser, whose interest in the German merchant marine is second only to that which he has shown in the upbuilding of the German navy.

The length of the "Imperator" is 900 feet, and she thus has the distinction of being the first ship to come within 100 feet of the 1,000-foot ship of which naval architects have been wont to speak in late years in naming the possibilities of length which might be reached before many years have passed. Her beam is 96 feet and her molded depth 62 feet. From the keel to the boat deck will be 100 feet and the distance from the keel to the trucks of the masts will be 246 feet. The three funnels will be oval in section, measuring 18 feet on the smaller and 29 feet on the greater axis. The rudder will weigh 90 tons and the diameter of the rudder stock will be 2½ feet.

The ship will be driven by turbines of 70,000 horse-power which will be developed on four shafts,



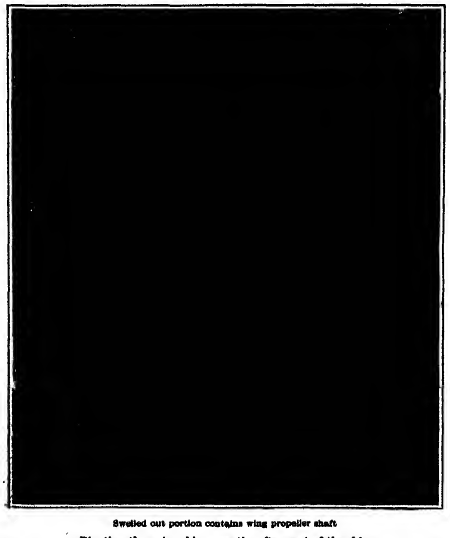
Length, 900 feet. **Beam**, 96 feet. **Displacement**, 65,000 tons. **Horse-power**, 70,000 **Speed**, 22½ knots **Passenger capacity**, 4,100 **Crew**, 1,100

The "Imperator"—largest ship afloat to-day.

and the estimated speed of the ship is 22½ knots. She will be equipped with water-tube boilers.

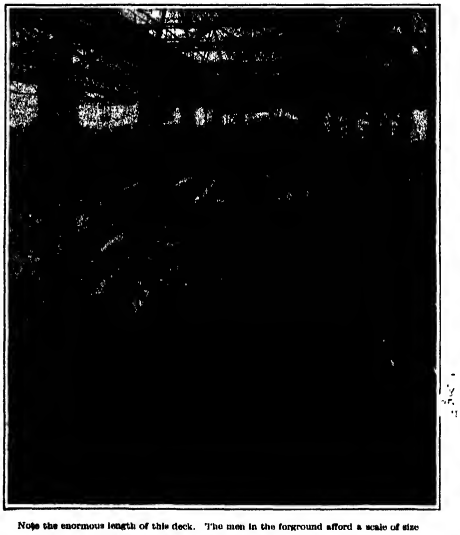
A feature of the ship which will be appreciated by passengers is that she will be fitted with the Frahm anti-rolling tanks, otherwise known from their shape as "U" tanks. This device consists of tanks of large capacity, built on opposite sides of the vessel and connected by an inclosed waterway, through which the water can flow from side to side of the ship as she rolls, its flow being subject to control by valves. Experience in the few passenger ships which have been thus equipped has shown the Frahm tanks to be the most efficient anti-rolling device yet tried.

With the "Titanic" disaster so recent a fact, the questions which at once arise with regard to the "Imperator" are those relating to her internal construction and particularly her construction below the water line. What provision has been made for meeting such a devastating accident as that which sent the huge "Titanic" to the bottom in two hours and thirty minutes? It will be remembered that in our article in the SCIENTIFIC AMERICAN of May 11th, we advocated either the use of a double skin below the water line, or the construction of longitudinal bulkheads to inclose coal bunkers carried along the sides of the vessel in the



Swelled out portion contains wing propeller shaft

Riveting the outer skin upon the after part of the ship.



Note the enormous length of this deck. The men in the forground afford a scale of size

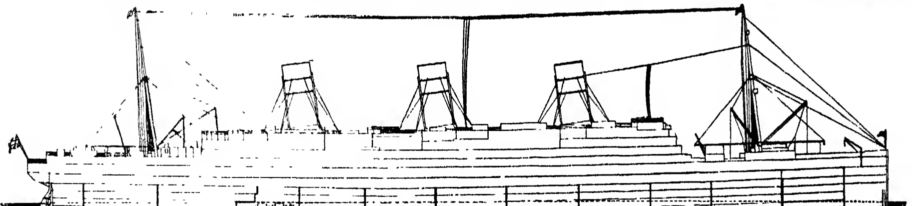
Laying the steel plating upon the deck beams.

wake of the boiler rooms. The sub-division of the "Imperator" below the water line has been carried out under the supervision of the Germanic Lloyd's and the Immigration authorities. It consists of a series of intersecting transverse and longitudinal bulkheads. Transversely, the ship is subdivided by twelve bulkheads, which are carried two decks above the water line, with the exception of the collision bulkhead forward, which extends four decks above the same level. These bulkheads are intersected by longitudinal bulkheads, which subdivide the boiler and engine rooms, the under water portion of the ship being divided altogether into twenty-four separate watertight compartments. There are four boiler rooms, containing the water-tube boilers, the type used on this ship. The coal bunkers are placed above the boiler rooms, and along the sides of the ship, in the latter case being known as wing bunkers. The longitudinal bulkheads are placed about nineteen or twenty feet in from the side of the ship, and they extend from bulkhead No. 4, aft to bulkhead No. 8. Astern of the aftermost boiler room is the forward turbine engine room, which is protected against flooding by two wing bulkheads, between which and the sides of the ship are placed the auxiliaries. The after turbine room is divided by a central longitudinal bulkhead.

Because of its great size, special interest attaches to the turbine installation. We present illustrations of one of the low-pressure turbines, from which one can gain a vivid impression of the great size and weight of the various parts. The rotor, or rotating part, contains 50,000 blades, and is capable of developing over 22,000 horse-power. The casing is 18 feet in diameter and 25 feet long. The shafting of all four propellers is 1½ feet in diameter. The propellers, which are made of turbadium bronze, are 16 feet 8 inches in diameter. Although the engines are spoken of as being of 70,000 horse-power, it is probable that on test they will develop from 80,000 to 85,000 horse-power.

The German government, in its supervision of the construction of passenger-carrying ships, pays as much attention to the question of fire-protection as it does to that of protection against sinking at sea. The tiers of passenger decks on a huge ship of the size of the "Imperator" are filled with a great amount of material of a highly combustible character, such as wainscotting, passenger stateroom partitions, paint, varnish, and general architectural embellishment. This material would afford highly inflammable fuel, should a fire once obtain a strong hold upon the ship; and the long alleyways, if they were not shut off at intervals by the screens, would afford an easy means for the spread of fire throughout the full length of the deck. To prevent this, light steel bulkheads are run from side to side of the ship throughout the passenger accommodation spaces. They are provided with fire doors and drills are held at regular intervals, in which the fire mains are in full service, and the work of closing the smoke doors is carried through by such members of the crew as are detailed for this work.

We are informed by the Hamburg-American Company that the "Imperator" will probably make her maiden trip to New York in the early summer of 1913.



The transverse bulkheads amidship are carried two decks above the water line, the height increasing toward the ends. There are twenty-four watertight compartments below water.

Inboard profile of the "Imperator."

The Interferometer Barograph

A NEW device for observing and measuring minute fluctuations in atmospheric pressure is described by Prof. Albert C. Crehore and Major George O. Squier, U. S. A., in the *Bulletin of the Mount Weather Observatory*. The detection of these fluctuations, which occur unceasingly, is a problem that is attracting increasing attention, both from meteorologists and aeronauts. The first apparatus for the purpose was the Shaw-Dines microbarograph; another was the variograph, introduced two years ago by Schmidt. The principle of the Crehore-Squier instrument, however, is entirely new. The apparatus includes a set of eight standard aneroid cells, from which the air is exhausted, such as are used in the familiar Richard barograph. In the latter the recording apparatus consists of a system of mechanical levers and a pen, registering on a revolving cylinder. The "lost motion" attending any such combination of levers and pivots in the nature of things obliterates all of the delicate and rapid motions that would occur in the cells if they were disconnected from the recording apparatus, so that only the grosser changes of pressure are indicated. The new instrument makes its record by the interference of light. A plane glass plate, silvered on its upper surface, is fixed horizontally on top of the uppermost aneroid cell, and rises and falls with it. A second glass plate, thinly silvered on the under side, is fixed rigidly above and parallel to the moving plate; the two plates form the interference system. The source of light is a mercury vapor lamp placed almost directly above the interference plates. A camera is so adjusted as to photograph the circular interference bands through a slit, the resulting image being a strip along a diameter of the circles. The image is impressed upon a film moving at a uniform rate. As the circles expand and contract, with changes in pressure, each interference band makes its record as a wavy or sinuous line. The exact time is registered on the film by the device of interrupting the light for an instant at the end of each minute. The motion of the cells is magnified, by this device, about 50,000 times.

Phosphorus Slag as an Insecticide

THE slag or dross formed in the removal of phosphorus from iron ore has been for years used as a fertilizer, on account of the phosphorus that it contains, and also on account of the lime. Recent investigation has shown that the use of this slag is even more profitable than had at first been supposed.

The cultivation of the sugar beet in Germany suffers great damage from the plant louse. The depredations of these bugs are destructive to a large number of plants. All mixtures or liquors used for spraying plants as a protection against these insects have been applied in vain. The "false brown rust" or "curl" of the peach is caused by the plant lice, and it cannot be successfully fought because neither liquors nor powders can be made to reach the little animals. When the beet plant is attacked, the leaf curls up and protects the insect against any treatment the farmer may apply.

It has been found that by the application of large quantities of nitrates after rains, the beet is stimulated to push out new leaves, which take the place of those destroyed by the plant lice. But this method has its dangers since an excess of nitrogen in the soil may be just as harmful to the plants as the action of the insects. J. P. Wagner, a sugar beet expert, recently told the National Society of Agriculture in France of a successful attempt to fight these insects by means of phosphorus slag. He spread about 1,400 pounds of the phosphorus slag to the acre on fields that were infested with the plant louse. Not only did this treatment prevent the insects from attacking the leaves, but they were driven away from leaves they had already attacked. On another field the slag was applied in larger quantities. Every plant was already attacked by the insects when the dross was applied. Within eight days all the insects had disappeared, and the plants recovered their healthy appearance and color.

The method by which the phosphorus slag operated in these cases is not known. Wagner thinks that the compound forms a thin layer on the leaf, spreading out over the whole surface, and that it is either distasteful or injurious to the insect. It is well known that many lime compounds are injurious to animals with soft, naked skins such as snails, caterpillars, naked larvæ; but it has not been shown that a similar effect is actually produced in the treatment against plant lice with phosphorus slag.

The Foundering of a Japanese Submarine

A Remarkable Letter

ON April 16th last, submarine No. 6 of the Imperial Japanese navy was lost while manuvering in Hiroshima Bay and all on board perished. She was commanded by Lieut. Takuma Faotomu, and after the vessel was raised, a letter of farewell from him was found in her conning tower. This remarkable document will be read with interest. The translation from the original published in the Japanese press, appeared in the Kobe *Herald*, and is as follows:

"Although there is indeed no excuse to make for the sinking of his Imperial Majesty's boat, and for the doing away of subordinates through my heedlessness, all on board the boat have discharged their duties well and in everything acted calmly until death. Although we are departing in pursuance of our duty to the state the only regret we have is due to anxiety lest the men of the world misunderstand the matter, and that thereby a blow may be given to the future development of the submarines.

Gentlemen, we hope you will be increasingly diligent without misunderstanding the cause of the accident, and that you will devote your full strength to investigate everything, and so secure the future development of submarines. If this be done we shall have nothing to regret.

"While going through gasoline submarine exercise we submerged too far, and when we attempted to shut the sluice valve, the chain in the meantime gave way.

"Then we tried to close the sluice valve by hand, but it was then too late, the rear part being full of water, and the boat sank at an angle of about 25 degrees. The boat rested at an incline of about 12 degrees pointing toward the stern. The switchboard being under water the electric lights gave out. Offensive gas developed and respiration became difficult. About 10 A. M. on the 15th the boat sank, and under this offensive gas we endeavored to expel the water by hand pumps.

"At the same time the vessel was being submerged we expelled the water from the main tank. The light having gone out the gage cannot be seen, but we know the water has been expelled from the main tank.

"We cannot use the electric current entirely; the electric liquid is overflowing, but no salt water has entered and chlorine gas has not developed. We only rely upon the hand pump now. The above has been written under the light of the conning tower, when it was about 11:45 o'clock. We are now soaked by the water which has made its way in. Our clothes are pretty wet and we feel cold. I had always been used to warn my shipmates that their behavior (on an emergency) should be calm and delicate, while brave; otherwise we could not hope for development and progress, and that at the same time one should not cultivate excessive delicacy, lest work should be retarded. People may be tempted to ridicule this after this failure, but I am perfectly confidant that my previous words have not been mistaken. The depth gage of the conning tower indicates 52 feet, and despite the endeavor to expel the water, the pump stopped, and did not work after 12 o'clock. The depth in this neighborhood being 10 fathoms, the reading may be correct.

"The officers and men of submarines must be appointed from the most distinguished among the distinguished, or there will be annoyance in cases like this. Happily all the members of this crew have discharged their duties well, and I am satisfied. I have always expected death whenever I left my home, and therefore my will is already in the drawer at Karasaki. (This remark applies only to my private affairs, and it is not necessary. Messrs. Taguchi and Asami please inform my father of this).

"I respectfully request that none of the families left by my subordinates shall suffer. The only thing I am anxious about is this. (Atmospheric pressure is increasing, and I feel as if my tympanum were breaking).

"12:30 o'clock, respiration is extraordinary difficult. I mean I am breathing gasoline. I am intoxicated with gasoline.

"It is 12:40 o'clock."

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Wright Machine in the National Museum

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the suggestion in "Aeronautics" column of a recent issue of the SCIENTIFIC AMERICAN that a national museum should acquire an early Wright flying machine, it may interest you to know that the machine which the Wright brothers flew at Fort Myer (Washington) drill grounds, and which was bought by the Government, now hangs in the old building of the National Museum, having been placed there by the War Department.

Washington, D. C. C. FRANCIS JENKINS.

Taxing the Professional Man

To the Editor of the SCIENTIFIC AMERICAN:

Replying to your question in the number for May 4th, page 394, first column: "What State levies a tax on members of the bar, or, indeed, of any profession?" permit me to say that for eight years, previous to a few years ago, I carried on business as a professional photographer at Newport News, Va., and that I paid an annual license fee of $51,75 for this privilege; part of this fee being for the city and part for the State. It was my understanding then that most, if not all, the professions, including the bar, were thus required to pay a license fee. And this was a charge in addition to any tax on property, both real and personal, including sewing machines and Bowie knives.

I think that this license taxation obtains in other Southern States besides Virginia.

Haines Falls, N. Y. SAMUEL E. RUSK.

Oregon's Roads

To the Editor of the SCIENTIFIC AMERICAN:

In reading your Good Roads number of March 16th, I find on page 240 the statement that you were unable to secure any information from the State authorities. You also state that the total mileage is less than 30,000.

I will be pleased to furnish you any information you may wish in the future, but I wish to correct the figures quoted by you Oregon had 34,258 miles of public highway in 1904, according to the United States Public Roads bulletins. My data are not quite complete, but a conservative estimate gives the State practically 40,000 miles to-day. About $3,000,000 was spent last year by the different counties and road districts.

Two sets of highway bills have been prepared for initiative action this year, both creating the office of State highway engineer One gives him absolute authority and empowers the State to issue bonds, the other makes him an advisory officer and leaves the bond issues to the separate counties.

Corvallis, Ore E. F. AYRES, Highway Engineer.

The Nut Problem Once More

[Those of our readers who have been following the correspondence on the problem originally published on page 174 (February 24th, 1912) will be interested in the letter reproduced below.—ED.]

To the Editor of the SCIENTIFIC AMERICAN:

I offer the following solution of the equation

$$A = 3\frac{53}{1024}F + 1\frac{452}{1024}$$

which seems to me to be more complete than the one you give in your Notes and Queries column, vol. cvi., No. 17, page 390:

$$A = 3F + 1 + \frac{53F + 452}{1024},$$

To find what integral value of F will make the fractional part integral, let

$$\frac{53F + 452}{1024} = M \text{ (integral)}$$

$$53F + 452 = 1024M$$

$$F = \frac{1024M - 452}{53} = 19M - 8 + \frac{17M - 28}{53}$$

Repeating the process:

$$\frac{17M - 28}{53} = N \text{ (integral)}$$

$$17M - 28 = 53N$$

$$M = \frac{53N + 28}{17} = 3N + 1 + \frac{2N + 11}{17}$$

Again:

$$\frac{2N + 11}{17} = P \text{ (integral)}$$

$$2N + 11 = 17P$$

$$N = \frac{17P - 11}{2} = 8P - 5 + \frac{P - 1}{2}$$

From which it is obvious that $P = 1$ gives the smallest integral value for N and the other letters in order backward.

$P = 1$
$N = 3$
$M = 11$
$F = 204$
$A = 624 = 1/5$ (whole number of nuts) $- 1$.

Whole number of nuts = 3,121.

New Bedford, Mass. FREDERICK D. STETSON.

Is Oxygen a Drug?

To the Editor of the SCIENTIFIC AMERICAN:

I beg to refer to your editorial "'Doping' Athletes with Oxygen," in issue of April 6th. In the same you declare Sir Edwin's proposal, to feed the Marathon runner with oxygen as with soup and water, to be "amazingly unscientific." At the same time you make several citations, as "oxygen jag," in which "ideas swarm, but it is hard to seize them;" and several statements, such as "Oxygen is a 'drug' that 'dopes' the recipient, quite like many other drugs;" "pure oxygen is a stimulant," but "as with all stimulants, excessive and occasionless use is dangerous;" and you speak of "oxygen intoxication"

I would consider it in the interest of sound knowledge if you would kindly mention the authority you cite against Sir Edwin's statement, as well as the source of your information. Interested in the subject of oxygen as any man would be who takes good care of his life, and gathering my information from authorities which I believe to be leading, I beg to differ with your opinion The question whether or in what degree the designations "stimulant," "dope," and "drug" are proper to be used for oxygen should be cleared.

To say that oxygen is a "stimulant" is very nearly correct, but more correct is to say that it is "the physiological stimulant." My authority on hand is Verworn, who in his "Allgemeine Physiologie" frequently mentions oxygen as "the only physiological stimulant and energy producer of living organism"

Among the "all stimulants" in which you seem to class oxygen, is there any one that is a physiological necessity, or one that forms a predominant physiological condition of life, as is the case with oxygen? If oxygen is a stimulant, we cannot do without it; all others are stimulants without which we do better. Similarly, I would ask if among the "drugs" that are "dopes," used to increase cardiac action, or in some way to artificially raise vitality, to exhilarate, if among these "doping" substances there is one which is a normal constituent of our system, or which normally circulates in our body fluids? I can think of none, except perhaps adrenaline

My further contention is that oxygen in the case of a runner is not used as a stimulant, but as a corrective for "lack of oxygen" and "metabolic abnormalities," that such stimulant as you have reference to is not needed in the case of the runner, and that oxygen in the most natural way can only benefit and never endanger the exhausted individual.

The heart of a runner beats abnormally rapid, therefore the mechanical part of the work of the circulatory system is highly efficient and a cardiac stimulant is not required. The real danger for the runner are fatigue and exhaustion. These are due to the accumulation of fatigue products and to lack of oxygen. Fatigue products are dissimilatory products of incomplete combustion Principally lactic acid is known to be produced by the work of muscles. Both lactic acid and lack of oxygen are reciprocal in cause and consequence, i e., lack of oxygen, due to the extreme draught under which the respiratory process is placed, is the condition for the formation of products of incomplete combustion; and again, acid products (fatigue products, lactic acid) formed in the muscles and circulating through the blood, result in conditions averse to normal oxidation as well as to oxygen absorption; hence lack of oxygen. This is a pathologic condition which can be remedied to a great extent by increasing the *partial pressure of oxygen for respiration.* It should be remembered also that in the case of the short distance runner or of hard work, oxygen consumption increases to seven or eight times the normal If our system had enough flexibility to correspond, feeding such increased demand steadily, and if the acid products circulating in the blood and in the tissues of the lungs would not interfere with adequate oxygen absorption, the organism might continue to be satisfied with a twenty per cent oxygen atmosphere. But experience has shown that such is not the case. Therefore, respiratory processes are greatly assisted by higher oxygen tension in the lungs, and this is accomplished by adding to the air which the panting runner breathes, pure oxygen, or enabling him to take a few breaths of oxygen unmixed. Bnt this is not exactly stimulation, and should it be called so because it increases the vitality by combating fatigue, it is stimulation by just the substance which physiologically is wanted.

As a few authorities on the physiology of running, on fatigue products, and on pathology of lack of oxygen, I may mention Zuntz and Schumburg ("Physiologie des Marsches"), Loewy-Zuntz, Müller, Caspari ("Höhenklimer," etc), Verworn, Mosso, S Schrotter, Haldane and Smith, Martin H Fischer

Oxygen "intoxication" is a layman's expression, and seems to me misleading for the numerous readers of your scientifically recognized paper. In the above sense we can speak of a "waste products intoxication" and of an oxygen "disintoxication."

Moreover, the difference between the physiological stimulant and any other stimulant is besides that the first is normally and at a normal fixed rate absorbed by the blood and the latter abnormally and at a non-fixed rate. I cite Nagel's "Textbook on Physiology of Man," I 1, p. 84; Christian Bohr, "Blotgase und Respiratorischer Gaswechsel" "With increased tension (of oxygen) the increased absorption follows at reduced rates, and before atmospheric oxygen tension (in the blood) is reached an increase of tension has but little influence upon the absorbed amount of oxygen, at saturation with pure oxygen under a pressure of 760 millimeters red blood corpuscles absorb proportionally insignificantly more oxygen than at saturation with atmospheric air." And the same, p 216 "When breathing gas mixtures enriched with oxygen or pure oxygen under atmospheric pressure at not excessively long periods, oxygen absorption and carbon dioxide secretion do not show important deviation from the normal However respiration of pure oxygen under a pressure of three to four atmospheres or respiration of ordinary air under a pressure of fifteen to twenty atmospheres acts quickly deadly, as has been shown by P Bert"

This of course is a condition which can only be produced in a laboratory by the necessary paraphernalia. But the above should bear evidence that the runner, who is under oxygen starvation on account of the pathologic "fatigue" condition of his blood, and even a normal individual, whose blood should be of normal oxygen capacity, runs no risk in breathing pure oxygen for a while, and that the word "intoxication" is physiologically out of place.

The immediate effects of oxygen inhalation are not felt by the reflectory nerves; in other words, produce no sensation Any man who, in breathing oxygen at higher than aerial partial tension, feels exhilarated and like getting an "oxygen jag," is either subject to imagination or the gas contains some impurity that produces the effect.

The soup or any nutriment which the runner consumes during the run I would, rather than oxygen, consider a stimulant or a tonic The effect which these produce is more in the nature of satisfying the secretive functions of the system than of supplying energy The energy in such extreme strain depends on the body's stores Water and oxygen are in my opinion the most needed factors in the maintenance of the energetic and respiratory functions of the system under extreme strain during a period of several hours I am however puzzled by your reference to "nascent" oxygen. Has Sir Edwin really said so?

I would conclude that we may consider oxygen a stimulant or *the* physiologic stimulant, a nutriment, an energy producer, a life sustainer, a corrective of depleted metabolism, or in general term, an invigorator—it is all that by nature of the physiology of organized life; but we should not consider it a drug or a dope, an intoxicant or narcotic, nor a danger, if pure and not dry.

I would deem it a favor if you will give publicity to this very brief outline on the rôle of oxygen in the case of the runner.

New York city RICHARD VON FOREGGER.

[Most controversy is over terms and definitions, rather than over ideas Pure oxygen is a stimulant, in that it excites a diffused and transient increase of vitality and energy Stimulants are oftentimes "indicated" in disease, but the use of any stimulant beyond the body's physiological needs is intoxication ("jag" in the vernacular). A drug is a medicament ("dope" in the vulgate); pure oxygen is such in anemic coma, lobar pneumonia, etc. Pure oxygen is not a physiological stimulant, but atmospheric air (oxygen 20 + parts with nitrogen 80— parts) is a most salutary physiological remedy Hydrogen is not a physiological remedy, but hydrogen + oxygen (H_2O) is Carbon (like H and O) is a constituent of the body, but it is not a physiological remedy. However, C, H, and O in combination (as soup, for example) make up a physiological remedy. Phosphorus, sulphur, iron, are essential constituents of the body, but not physiological remedies The editorial writer would restate his main thesis that the drugging of Marathon runners (the race is of some 26 miles) with pure oxygen would tend to physical disaster, sooner or later, for the man thus stimulated beyond his natural powers; and would be most unfair to those competitors who depend frankly upon their own natural capabilities, adjusted to natural environment, for the victory. Lankester is not responsible for the term "nascent oxygen;" the editorial writer used it in the sense of "uncombined oxygen."]

A New Use for Potatoes

Raising Potatoes in Germany for Industrial Purposes

By H. C. Price

WITHIN the last ten years a new industry has sprung up in Germany which has already become of large commercial importance, namely, the drying of potatoes for stock food. This is done in potato-drying factories that are rapidly increasing in all parts of the empire. How rapid this increase has been is shown by the fact that in 1907 there were but 118 such factories in Germany and last year there were 404 in operation, notwithstanding the fact that in that time the potato crop of Germany was the poorest they have had for many seasons and the price unusually high.

German Potato Crop.

Germany grows nearly five times as many bushels of potatoes as the United States. They produce on the average two and one half times as large an area and the yield is twice as much per acre. In fact, only two other crops, those of rye and oats, surpass the potato crop in acreage in Germany. In America potatoes are grown exclusively for human food, but not so in Germany; immense quantities are grown for industrial purposes and used for manufacturing starch and denatured alcohol and for drying, all of which are important industries. The market quotations are given regularly for potatoes for eating purposes and potatoes for manufacturing purposes and the price of the latter, as a rule, is about two thirds that of the former.

Much attention is given to breeding potatoes for starch content and experiment stations are maintained in the various provinces to test the different varieties for yield of potatoes, yield of starch per acre, as well as per cent of starch content. The test this past season of one hundred and twenty-five varieties, showed a variation in the per cent of starch content in the different varieties grown under the same conditions of from 12 per cent to 25 per cent.

The Germans have paid particular attention to developing the starch content of the potato in order to increase its value for manufacturing purposes and in doing so frequently lose in size of tubers and yield per acre.

Development of the Drying.

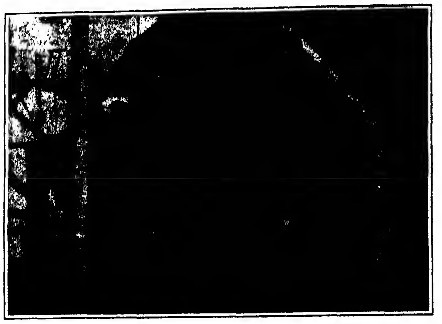
The development of the potato-drying industry has been the result of over-production and low prices. With such large areas grown, as is the case in Germany, in years of good crops there is a large over-production. In such years formerly the farmers were obliged to accept ruinously low prices for their crops and were at the mercy of the potato merchants. The potato being perishable, it cannot be carried over from one year to the next as is the case with grains. It is easily frozen and when once frozen is ruined, so that the disposition of a surplus in a good crop year was a serious problem.

For some years the Germans had been drying the sugar beet pulp from the sugar factories (after the sugar had been extracted) and using it as stock food. This gave rise to the suggestion of using the surplus potatoes in the same way. This would not only utilize the surplus but would preserve it in a form in which it could be held indefinitely and stored without danger of freezing. It would also take the surplus off the market and insure a reasonable price for the rest of the crop.

The government and the agricultural organizations offered large prizes in the latter part of the nineties for the most successful methods of preserving potatoes, both for human and stock food. As a result a large number of methods and kinds of apparatus were offered, so that it can be said by 1900 entirely successful methods had been perfected.

Two Methods Used.

There are two types of drying apparatus on the market. The one produces the so-called potato "schnitzel," which is made by shredding the raw potato into pieces about as thick as a small lead pencil and drying it under very intense heat. The other produces what is known as potato "flocken" flakes. In this latter method the potatoes are first cooked by steaming and then mashed and dried by passing between hot rollers by steam. Since the rollers are placed near to one another, the mass passes between like a sheet of paper. The heat causes them to adhere to the exterior walls of the rollers and the motion is so regulated that they are completely dried before the rollers have half completed the revolution. Two knives on the outside of the rollers cut off the dried mass, which has a bright yellowish-white appearance, a good smell, and forms a coarse sort of potato meal.



Apparatus for manufacturing flocken.

A potato-drying factory in Germany.

One type of potato-drying machinery.

In the drying of the raw potatoes, the shredded pieces are first exposed to very great temperatures, often as high as 1,000 deg. Cent (1,832 deg. Fahr.), as they are carried slowly through a long chamber with the temperature constantly decreasing. When they go into the drying chamber as raw potatoes they contain 75 to 80 per cent water, and when they come out as the dried product or "schnitzel" they contain 12 to 15 per cent water. In the manufacture of the flocken such high temperatures are not necessary, as the potatoes are first cooked, but when finished they contain approximately the same amount of water as the schnitzel.

The amount of raw potatoes required to produce one hundred pounds of the dried potatoes, depends upon the starch content and dry substance in the potatoes used, as well as upon the amount of moisture contained in the finished product. The following table shows the amount of dried potatoes, either as schnitzel or flocken, containing 15 per cent moisture that can be produced from potatoes of different qualities:

Amount of Raw Potatoes Required to Produce 100 Pounds of Dried Potatoes, Containing 15 Per Cent Moisture, and When They Contain

Per Cent.	Per Cent.	Lbs
12 starch	17.8 dry matter	480
14 "	19.8 " "	460
16 "	21.8 " "	390
18 "	23.8 " "	360
20 "	25.8 " "	330
22 "	27.8 " "	310
24 "	29.8 " "	290

Use of the Dried Potatoes.

The dried potatoes, both schnitzel and flocken, are used as food for horses, cattle, sheep and swine, and have come to be an important product on the market and are regularly quoted in all market reports. The potato flocken is preferred, as it is more digestible, and of the 404 factories in operation last year, 314 were equipped to manufacture flocken. That may be due in part to the fact that it does not cost as much to install an apparatus to manufacture potato flocken as it does to manufacture schnitzel. On the other hand, after the equipment has been installed, the potato schnitzel can be manufactured more cheaply than the flocken. The Germans count that it costs $1 to $1.50 per ton of fresh potatoes to dry them in the form of schnitzel and $2 to $2.50 per ton to dry them in the form of flocken.

Although dried potatoes may be used for all classes of livestock, as a matter of fact, they are used principally at the present time for swine. Experiments and practical experience have proven that dried potatoes may be used almost entirely to replace corn in the ration, and this is of decided advantage to Germany, since all the corn that is used has to be imported.

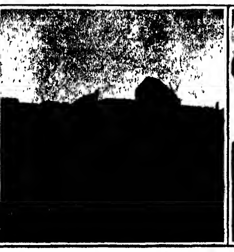
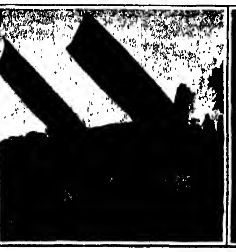
Advantages of the System.

The extent to which potatoes are dried from year to year for stock food depends upon the crop. In years of over-production the surplus is dried and thus put into a form that can be preserved for an indefinite length of time. By drying the surplus the farmers are saved from ruinously low prices for their crops. In years of short crops, such as last year, it is used principally to utilize the culls and potatoes that are not suitable for human food. The dried potatoes are not only in a form that can be stored without danger of frost and for any length of time, but the weight is reduced about three-fourths, so that the cost of transportation is reduced in like proportion, and surplus in one section can be shipped to other sections of the country without great expense.

The system has passed the experimental stage and has taken a permanent place in the agricultural manufacturing industries of Germany.

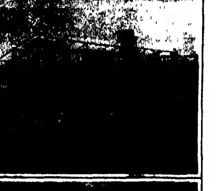
The Failures of the "Aviettes"

Impossible Performances for an Impossible Prize





PERHAPS it was merely a desire for publicity, perhaps an exuberant sense of humor, that prompted Peugeot Frères to offer two prizes for flights made with the aid of human muscular energy alone. Surely at this late day no one, and least of all a firm of bicycle manufacturers, can plead gross ignorance of the first principles of cycling and of aviation, by offering a first prize of 10,000 francs for a machine which, propelled by human power alone, would cover a distance of 10 meters (32.8 feet) twice in opposite directions, and a second prize of 1,000 francs for a machine which would cover a distance of 1 meter (3.28 feet) at a height of 10 centimeters (about four inches).

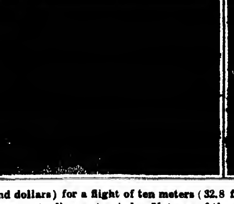
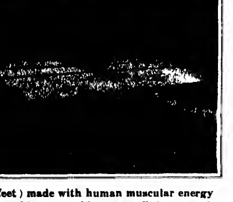
Although neither prize could possibly be won (the machines had to run on level ground, and having covered the prescribed distance, were to turn immediately and fly back to the starting point), Paris evinced an extraordinary interest in this *Concours de l'Aviette*. No less than one hundred and ninety-eight entries were received, but only twenty-three covetous aspirants to aviation fame appeared on the scene at the appointed hour. In the expectation of seeing a very novel contest, no less than two thousand five hundred people witnessed the futile attempts of most of the twenty-three to enrich themselves at the expense of Peugeot Frères. There was much hooting, much whistling, much jeering, and much mock encouragement.

The ignorance displayed by many of the designers of the machines entered is simply amazing. Even elementary principles were ignored. Almost every one of the machines that appeared at the Parc des Princes on June 2nd could not possibly get up a speed of more than fifteen miles an hour, so heavy were they. Wings had been mounted on bicycles, apparently with no conception of the relation of lifting effect to speed and area of supporting surface. Some of the machines were provided with elevating and vertical rudders; some had no guiding device of any kind, some were fitted with propellers, and some had no propellers at all. Apparently none of the men who entered realized that a regular motor-driven flying machine must have a speed of at least twenty-five miles an hour before it can vault into the air. Twenty-five miles an hour on a bicycle is a remarkably creditable performance. Riders who have made it know how considerable is the wind resistance encountered even at that rather moderate speed. The dramatic performances of men who have ridden behind railway trains (intended primarily to minimize air resistance) have evidently been without effect upon the general reading public. If a bicycle rider finds it difficult to travel at high speed on the open road, how is it possible for a man on an "aviette" to acquire a preliminary speed great enough for him to launch himself into the air, when at either side of the machine wings are to be found that have an area of forty square feet and that offer an enormous head-on resistance?

Obviously impossible as it was to rise from the ground even with a monoplane aviette, some of the contestants were foolish enough to attempt the feat with biplanes. An inventor named Piat, of Boulogne, for example, entered a biplane designed somewhat on the principle of a Farman machine. Another, from Montrouge, named Vincent, made attempt after attempt to win the 1,000-franc prize with a batlike machine fitted with double wings. Throughout the day he made effort after effort to get into the air. Again and again his friends started him off toward the track. The manner in which his performances were received by the crowd may be conjectured.

Although no one succeeded in leaving the ground, consolation silver medals were awarded to the sixteen men who trundled out their machines and had the courage of their convictions. The contest was supervised by a *Commission de l'Aviette*, consisting of Jacques Balsan, de Knyff, Etienne Giraud, Isaac Koechlin, Rodolphe Koechlin, Tissandier, Paul Rousseau, Frantz Reichel and Alibert. The prize offer remains open until the spring of 1913. It is said that another contest will take place some time in the month of October.



A French firm of bicycle makers offered a prize of ten thousand francs (two thousand dollars) for a flight of ten meters (32.8 feet) made with human muscular energy alone. One hundred and ninety-six machines were entered, of which twenty-three were actually constructed. Not one of the machines was able to get off the ground.

Club moss (*Selaginella*).

Horse-tail or scouring rush (*Equisetum*).

Common sweet pea.

A tip of one of the Indian hemps with fibrous bark and milky juice (*Apocynum*).

These specimens are inlaid on cardboard, the brilliancy of natural colors fully preserved and the mounting as smooth as a water color painting.

Preserving and Mounting Plant Specimens

How Pressure and Heat Can be Effectively Used

By Clara Reese

A SIMPLE and effective method of preserving plant specimens has been discovered. The process is likely to revolutionize the present slow and laborious preparing and mounting of herbarium collections. As a matter of scientific experiment the botanical department of the University of Pittsburgh, Pa., is giving the new process a trial.

The plant specimens to be mounted are brought in fresh and moist from garden or conservatory. These are subjected to a forced process of drying which preserves the natural colors of stem, leaf and flower. After this they are imbedded, or inlaid, on a yielding surface such as blotting paper, cardboard, silk, woolen or rubberized material, and when finished present the smoothness and evenness of a painting.

In demonstrating the process for me the inventor broke a leaf from a primrose plant in the presence of the writer. This leaf was laid smoothly on an ordinary piece of blotting paper. The blotting paper in turn was laid on a small steel plate neither much larger nor much thicker than a 5x7 camera negative. Several sheets of blotting paper were piled upon the primrose leaf to absorb the moisture and the whole laid upon the bed plate of an ordinary toggle press of hand leverage. A few steel plates were thrust in upon the blotters in order to build up the material to a thickness to meet the requirements of the press. Before applying the leverage, heat was introduced into the bed plate by means of a small pipe and a stopcock. The lever was forced down by hand, and at the expiration of thirty-five seconds, a cold draught succeeded the hot one in the bed plate, and the dried specimen was removed. It showed its original freshness, while the heat bath it received, somewhere about a temperature of 200 deg. Fahr., effectually destroyed all germ or insect life.

By immersing the card in cold water for an instant, the dried leaf slipped easily from the card. It was then laid upon the sheet to which it was to be permanently mounted or inlaid. Practically the same process in the toggle press for the permanent mounting was gone through with though "arms" were adjusted to the lever in order to give a higher degree of pressure and less heat was turned on in the bed plate. The inventor gives the completed specimens a final wash of liquid celluloid and alcohol as a protection to the same in case of rough handling.

The discoverer of the process is William Heeren, who has spent most of his lifetime as a skilled artificer in precious metals. Mr. Heeren appeared before the Botanical Society of Western Pennsylvania at a recent meeting and exhibited many of his imbedded specimens. As yet he has not succeeded in the inlaying of the natural plant in a ground of silver or gold, but he claims perfection so far as a yielding surface is concerned. He has hundreds of specimens and has subjected these to severe tests to prove the preserved colors as lasting and the inlaid growth as practically indestructible.

Mr. Heeren has kept his finished specimens under water for a week at a time and has lifted out the cards with their inlaid growth still unimpaired. He has imbedded his leaves and flowers in celluloid or transparent ground and hung them for months in the window in the sunlight as "transparencies." He has used his mountings as decorative lamp shades and as shades for electric bulbs and after a heated test of six months or more of household and office routine use, the roses, pansies, violets and ferns are as bright as ever in their first color. Others are hung where they are subjected to atmospheric changes.

This experimenter is equally successful in imbedding specimens whether of thick-stemmed and woody variety or of the most delicate and feathery of plant growth. He has inlaid clumps of moss and corsage bouquets of violets, and he has inlaid the delicate tracery of asparagus vine and the dainty petal of a rose. He has inlaid heads of grain, princess feathers and specimens of cattail, and he has likewise inlaid the ethereal quaker lady, the sweet pea and wood violet. There has really been no limitation in his experimentation, and sprays from bridal bouquets find themselves imbedded in small pieces of celluloid as ready for mounting as brooches and buckles.

A floral belt has a place in his experiment collection. In this instance the moss rose buds have been imbedded in a durable yielding strip of material. As the strip came from the hydraulic pressure, a corded ribbon of rich quality was laid over the strip and the whole put through a roller. The ribbon was then peeled off and the belt strip appears with its silken and corded markings. Many dainty "trimmings" of sheer material and silken fabric have their inlaying of delicate flower or vining. Mr. Heeren has not confined his experiments exclusively to plant growth, but butterflies and brilliant-hued insects are imbedded in a lasting manner. A most perfect and rich specimen of a peacock's feather is inlaid on a black rubber panel.

Mr. Heeren is not a botanist and will likely develop his discovery along ornamental lines as suitable to his craftsmanship. His workshop shows the ornamental trend in the grouping of blossoms and colors and ideas for fans, handbags, girdles, gift cards, brooches and buckles, likewise lamp shades and transparencies. The possibilities in these lines are endless.

Nevertheless, Mr. Heeren is making a herbarium by the usual process and is mounting specimens of plant growth the old way as a comparison with the new method. By the old plan the specimens are carefully arranged on bibulous paper, and pressed between smooth boards by putting weights or using a screw press. The paper is changed every day or two as the plants part with their moisture. When the process of desiccation is complete the specimens are fastened on sheets of paper by gummed strips. To protect these dried brown specimens from the ravages of insects, camphor is renewed frequently in the cabinets.

In his demonstration before the Botanical Society, Mr. Heeren contrasted the two methods and showed how the new way in the hands of botanical experts might bring a practical herbarium within reach of the ordinary class room without danger of mounted dried specimens breaking loose from cards or of destruction by insects. The "wash" given the inlaid cards preserves the specimens from inroads of insects. He showed how science might utilize the method likewise in a systematic arrangement for a large herbarium.

Mr. Heeren showed also how outlines might be printed for the youthful botanist to properly color. He deftly lifted an inlaid specimen out of its tight bed and showed how the matrix or impression might be used for printing an outline on drawing paper. He has examples of this outline printing as accurately defined as an engraving. In the hands of the skilled botanist, the inventor says, there is no reason why plant and flower should not be preserved in natural color and desired arrangement with much less waste of time, labor and space, than at present.

Mr. Heeren's discovery is the further development of an idea of his which is now classed as a successful invention, namely, the celluloid tags or number plates seen everywhere on the caps or coats of expressmen, messengers, porters and others in uniformed service. As the numbers are separate with each individual, these numbers are necessarily inlaid by a quick process. These smooth white disks with their black numerals are turned out in great quantities in a special factory under the supervision of the inventor. The curved plates for the caps are shaped on a curved bed plate in the toggle press. On a recent round the world trip, the inventor met his tags in every land and introduced himself in Alexandria, Egypt, by removing one from the cap of a porter and pointing to the firm name and address on the under side.

The Practical Use of Seaweed

SIX kinds of seaweed are used in the construction of Japanese isinglass, or agar-agar, the method of manufacture being described as follows in a recent U. S. Consular report: The seaweed is first crushed, each kind separately, to remove shells or other adhering matter, and then washed clean with water. The washed seaweed is placed on a mat and dried until its color becomes white by the action of the sun, frost, and dew. This operation takes place during September and October, and when bleached the weight of the seaweed is decreased nearly one-half. After bleaching, the six kinds of seaweed—in the proportion of Izu, 4; Egokusa, 4; Misaki, 3; Hirakusa, 3; Nanbu, 4; and Onikusa, 2—are all put together in a boiler and cooked for about 14 hours, until they have become soluble. The liquid is then strained through a sack and a box with a bamboo sieve on one side, from which it runs into a container. From the container the liquid is ladled into trays about 3½ feet long and 3 inches deep. After remaining in the trays about 12 hours these are placed on a low stand, and the isinglass is cut into strips 3 inches wide and 14 inches long, with a knife and ruler. These strips are then put into a long closed wooden box (the ends of which are 3 inches square, one end being open and one filled in with a wire sieve) and pushed through the sieve end in the form of long fine strips. The isinglass is then placed on a low stand, which is covered with a clean mat, and dried in the sun during the day and frozen during the night for two or three weeks during January and February, being watered at midnight.

The Laboratory

Some Suggestions for Home Experiment

Experiments With High-frequency Currents

By Philip Edelman

THERE is perhaps no one piece of apparatus so interesting as a high-frequency or Tesla coil. With it the laws of electricity are apparently violated. Thousands of volts are taken into the body with no unpleasant effects, lamps are lighted without connecting

Fig. 1.—The completed coil.

wires, insulators become conductors, and various other wonders are accomplished. There is no end to its wonders, and yet it is a comparatively simple piece of apparatus.

There are two general types of these coils, the oil-immersed and the open-air kind. For performing the following experiments the latter type will be described, as it is much simpler and accomplishes the same results.

The secondary of the coil is wound upon a paper or fiber tube 10½ inches in diameter and 10½ inches high. Beginning ½ inch from one end, wind 80 turns of No. 28 spring brass wire upon this tube. Wind this wire on very carefully, spacing each turn 3/32 of an inch apart. About 1/3 pound of wire will be needed. Give the finished secondary several coats of orange shellac, allowing each coat to dry before applying the next. The ends of the wire are fastened to the tube by punching two holes in it and sewing the wire into them.

For the primary winding, form 7½ feet of No. 4 rubber or weatherproof covered wire into two turns 13 inches in diameter and as near to a perfect circle as possible. The complete coil is shown in the photograph, Fig 1.

The accessory apparatus necessary are: a ¼, ½, or 1 kilowatt transformer or large spark coil, a large condenser, gap, etc. The transmitter of a wireless station will just about conform to these requirements. This Tesla coil will work to some extent even on a 1-inch spark coil. It gives a 3 to 5-inch spark on ¼ kilowatt, according to the adjustment.

Two methods of connecting the coils are shown in Fig. 2, an alternative form being given in Fig. 3. The success of the coil depends on the adjustment. You must have the right amount of capacity (condenser) and the right length of spark gage or you will get but poor results. You can only determine this by trial. After you have found the right proportions and the coil is sparking well, you are ready for the experiments.

Ground the lower terminal of the coil and close the switch controlling the spark coil or transformer. Now bring your hand near the top of the coil. These experiments are best done in the dark. Before you bring your hand near the coil, the top of the secondary glows with a beautiful corona brush. I have seen this done with a 15-kilowatt outfit. Snake-like twisting sparks shot out from the top. You may be able to see these on a small scale. As your hand approaches, a beautiful blue brush forms between it and the coil. The color intensifies until—"Ouch!" A spark jumps to your hand and stings you. Now hold a pair of pliers, screw-driver or any metal piece in your hand and repeat the

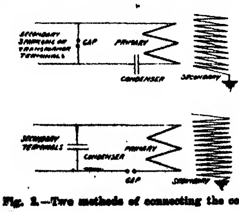


Fig. 2.—Two methods of connecting the coil.

experiment. This time the spark jumps to the metal and then into your body. If you are using less than ¼ kilowatt in the coil you will not feel any pain; ½ kilowatt will sting a little

You may wonder at this. You know that if this had been an ordinary spark at low frequency it would have been a terrible jolt, if nothing worse. Roughly counting 15,000 volts to the inch, you can readily calculate what you have just had through your body. But high-frequency currents, unlike low-frequency currents, travel on the outside of a conductor, and do not penetrate the inside The current travels on the outside of your body, and does not penetrate to your nerves. The sting you felt was caused by the heat

After you have become accustomed to taking this spark, grasp an incandescent light bulb in your hand, as shown in Fig. 3, and bring it to the top of the coil Sometimes in doing this the filament is jerked to pieces. An 8 candle-power lamp works best. The filament lights up Try the lamp on the middle and also near the bottom of the coil The lamp lights up brighter near the bottom than on top. There are numerous variations to this experiment For instance, two lights can be lighted, as shown in Fig 3.

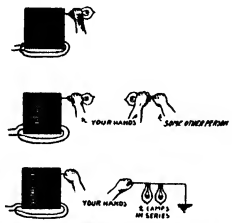


Fig. 3.—Lighting lamps without wires.

Now grasp a lamp by the bulb (it may be a burnt-out lamp) and allow the spark to jump to the capped end of the bulb. Little webs of sparks will form and the filament will dance around The filament may get red hot The bulb is now charged and if you put your other hand on the cap you will get a good shock. The bulb may be discharged to some one else, the ground or any conductive body.

Holding a burnt-out bulb by the cap, bring it near to the coil At first it lights up a pearl green. Next bring it very close for a second, allowing the spark to puncture the glass, when it will turn a pink color, and then of you continue a while longer it will turn a purple color. While it retains this purple color it is quite sensitive, and lights up if held in the hand a few feet away from the coil. These effects vary with every bulb used. Sometimes exceptional effects can be seen, while at other times nothing extraordinary happens.

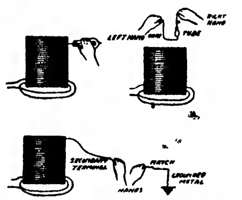


Fig. 4.—Experiments with burnt-out bulbs and lighting a match.

Geissler tubes held several feet away from the coil light up brilliantly. They are real wireless lights because there are no connecting wires. You can trace the lines of force to a slight extent by changing the direction and position of the tube and noticing the change in the brightness of the tube A strange effect is shown by Fig 4. Your hand and the tube form another secondary of the coil Besides the tube's lighting, little sparks pass from the hand to the tube If you vibrate the tube backward and forward rapidly, you can see little bands of light and shade.

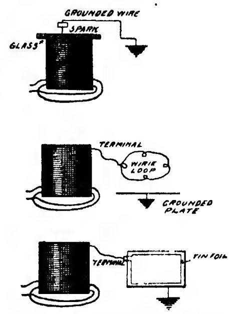


Fig. 5.—Curious brush discharges and illuminated signs.

You remember the burning sensation of your first spark To prove that this spark is very hot, you can light a match by it. It is best to use a pair of pliers for comfort You can burn wood, paper, light a candle and powder in this same way Try the experiment with these materials, as shown in Fig 4.

If a glass plate is laid on the coil as in Fig 5, the spark will seem to pass right through it. But the glass is not pierced, instead the spark is transferred to the other side of the glass by condenser action.

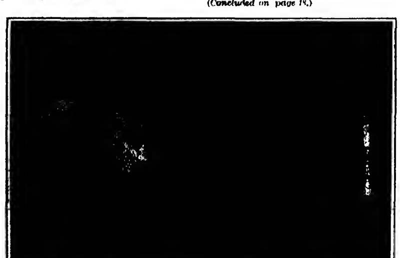
By forming loops of various shapes, as in Fig 5, you can get some very pretty brush discharges from your coil A name sign, Fig 5, is prepared by coating one side of a glass plate with tinfoil and the other side with the name, formed with fine wire A terminal of each side of the coil is connected to the plate and the name respectively.

Some Experiments With Blue Glass

By Prof. Gustave Michaud, Costa Rica State College

COMMON blue glass owes its color to the presence of cobalt It is transparent for the two extreme regions of the spectrum, red on one side, blue and violet on the other. It stops most of the central spectrum, i. e., orange, yellow and green From that point of view especially, it is altogether different from the yellow and red glasses used in photography and for which the absorption spectrum is unilateral That the cobalt glass allows the free passing of the extreme red is by no means evident at first sight, and it seems as if only pure blue light were admitted In the extremely simple experiment described here the red light admitted with the blue and violet is caused to stand away from both and thus becomes visible. This experiment is probably the only one in which an absorption spectrum can be distinctly perceived without prism, diffraction grating or apparatus of any kind

(Concluded on page 18.)



The eye used as a spectroscope.

Inventions New and Interesting

Simple Patent Law; Patent Office News; What Inventors Are Doing

A new gun for use on aeroplanes.

The Lewis Gun for Aeroplanes

By William Joseph Wheatley

WHEN an aeroplane soared aloft from the Army Aviation School at College Park, Md., the first part of June, carrying a new rapid-fire gun, the invention of Lieutenant-Colonel Isaac N. Lewis, of the United States Army Coast Artillery Corps, these machines left the realm of air scouts and from that time forward became active engines of war for both offensive and defensive work. The possibilities of the new gun were realized when the aeroplane came down after Capt. Charles deForest Chandler, commandant of the school, who manned the gun on its air trip, had discharged a full magazine of fifty cartridges, and an examination of the target had disclosed the fact that the forty-five shots fired had buried themselves in a space three yards by eighteen. The white target of cheesecloth measured three yards by fifteen, and while a number of shots had pierced the cheesecloth, the greater part were hunched just off the end. Five of the shots from the magazine had been sent into a fishpond on the reservation in order that Capt. Chandler could get, by the splash of the water, an instantaneous report of the accuracy of his aim.

The aeroplane, driven by Lieutenant Thomas DeW. Milling, one of the army aviators, was humming through the air at approximately fifty miles an hour, and at an altitude of 600 feet, when a ripping sound heard above the roar of the engine told that the gun was in action. Twice again the aviators flew over the target until the magazine had been exhausted. The fact that this was the first time the gun had been taken aloft together with the trueness of the aim as shown by the examination of the target spoke emphatically then and there of the great possibilities of fleets of aeroplanes loaded with these rapid-fire guns, soaring over a column of the enemy's troops.

No smoke, no flame—only the sound of the explosion tells that the gun has been fired. There is no recoil and the gun is so balanced by the magazine that the aim is not even interrupted while the gun is being fired. It can be fired at as high a rate as 750 shots a minute, but the rate may be reduced to 350 shots per minute, or to any number between those limits, by a simple adjustment of the gas-port valve controlling the admission of the gas to the piston cylinder.

The principal and most novel feature of the gun is its air-cooling system. The 30-caliber gun barrel is surrounded by a close-fitting aluminium jacket, cylindrical in form and having some twenty deeply-cut longitudinal grooves which extend from breech to muzzle. The gun barrel with its grooved jacket is inclosed in a light steel tube 3¾ inches in diameter, the portion of the tube which projects beyond the muzzle having a reduced diameter of only 2⅛ inches. The inclosed grooves, forming continuous air ducts in the aluminium jacket throughout its length, have free communication with the atmosphere at the breech and each time the gun is fired the ejector action of the discharge blast sucks in a draft of cool air from the rear through these ducts, thus carrying off the heat transmitted to the jacket from the barrel. The cooling is automatic in action, without the use of water or other cooling liquid and without mechanism or moving parts. As aluminium has six times the heat conductivity of steel and but one-third its weight, this very effective method of cooling the gun adds but a few pounds to the total weight carried. Another novel feature which differentiates the Lewis gun from all other gas-operated guns is the small inclosed operating spring which is located near the trigger-piece at the breech far removed from all injurious heat effects. The temper of this spring cannot be affected by either direct or transmitted heat no matter how rapid and long-continued the firing.

When firing at full speed it takes approximately four seconds to discharge a magazine of fifty cartridges, and the empty magazine may be replaced by a full one within two seconds. The drum magazine used with this gun is 8¼ inches in diameter and 1½ inches deep. It is stamped from sheet steel, has an aluminium center piece to hold the cartridges in place and resembles, somewhat, a reel used for winding cinematograph films.

Colonel Lewis designed the gun primarily for infantry and cavalry use, but its flameless feature coupled with the absence of recoil and its light weight brought to mind the possibilities of the rifle for aeroplane use, and a test was decided upon with the success already noted.

The development tests of the gun, which have been in progress for the past two years, show that the barrel does not become overheated under continuous fire at full speed, and that it will not therefore be necessary to carry along an extra barrel when on the firing line. Since no cooling water is necessary, and no special mount except a small stake or "cow-boy" mount weighing about eight pounds, the field equipment of the Lewis gun is reduced to a minimum. The gun may be fired from any natural support found in the field such as a rock, log, stump, tree or mound of earth. It is even possible to empty a magazine while holding the gun to the shoulder or from the hip, as the recoil effect is very slight.

It is a matter of note that one of the most conspicuous things on the battlefield in South Africa was the jet of steam from the boiling water which was being used on the barrels of the rapid-fire guns for cooling purposes.

Weighing as it does a little more than twenty-five pounds and requiring but one man to operate it, Colonel Lewis' invention has certainly made a great stride toward developing the aeroplane into a first-class ship of war.

The gun is simplicity in itself. It has only forty-seven parts, as compared with twice that number for other rapid-fire guns. On the battlefield or in the air where tools are necessarily scarce, and where they are needed more than anywhere else when they are wanted, Colonel Lewis' invention would certainly cause no worry, should some piece of the mechanism be broken or otherwise get out of working order, since the only tool required to disassemble or assemble the gun is the point of a bullet.

The sustained rapidity of fire of which the gun is capable makes it a far more dangerous and effective weapon than any bomb-dropping device as yet devised.

The men who tried the gun.

The gun in use from the ground.

As soon as a new machine is delivered to the Signal Corps to replace the flier which was wrecked recently, further and more complete firing tests of the Lewis gun will take place at College Park. It is proposed to carry the gun and one thousand rounds of service ammunition to heights of 1,000 feet or more and fire at selected targets to determine the accuracy of fire at different heights and speeds. The results of these firings will no doubt have far-reaching effect upon navy and coast defense plans for the future. However, with the results already obtained in view, it seems only a question of Congressional appropriation to decide whether or not we are to keep the lead in aeroplane armament.

Another question brought up in connection with the possibilities of this gun is its ability to attack the men on the decks and in the fighting tops of battleships. Battleships of the future, of course, will be equipped with hydro-aeroplanes for scouting purposes and even, possibly, to report the gun ranges of the enemy. Should these hydro-aeroplanes each be equipped with the Lewis rapid-fire gun they would play havoc with the range-finders telephones, lines of communication and the personnel in the fire-control masts such as those with which the battleships of the United States are equipped. It would mean that the men who direct the fire of their guns from these fighting tops will have to be protected. Some form of overhead protection will undoubtedly be necessary to protect the fire-control personnel, and naval officers of the various bureaus are, it is said, much exercised over the possible effects of attempting such protection.

The gun made a very successful demonstration of its possibilities as a service weapon for the mobile army at Fort Myer, Va., recently, before Secretary of War Stimson, Major-General Leonard Wood, Chief of the General Staff Corps; Brigadier-General William Crozier, Chief of the Army Bureau of Ordnance; Brigadier-General Erasmus M. Weaver, Chief of the Coast Artillery Corps; Brigadier-General E. A. Garlington, Inspector-General, and Brigadier-General E. H. Crowder, Judge-Advocate-General.

A $10,000 Prize for a Practical Sugar Beet Puller and Topper

THE Great Western Sugar Company of Denver, Colo., has offered a prize of $10,000 for a practical sugar beet puller and topper which shall fill the specifications given in a circular published by the company and which may be obtained free of charge on application to the company. From this circular we glean the more salient conditions as follows:

The beet puller and topper must fulfill the required specifications to the complete satisfaction of a committee of judges appointed by the company.

The offer may be in force until the first day of March, 1915, but the prize may be

awarded at any time prior to the first of March, 1915, when a practical beet puller and topper is forthcoming.

If two or more contestants fulfill all the required conditions and specifications, the committee of judges are to exercise their sole discretion and are to award the prize to the one who in their opinion has solved the problem most practically.

The contestants will be required to demonstrate their machines at such times and places as the committee of judges may designate. The contest is open to the general public including the employees of Great Western Sugar Company, and of all sugar companies.

The Great Western Sugar Company by awarding the prize will acquire no interest in the invention, design or machine of the successful contestant.

The motive power required for different soil and weather conditions must not be excessive, that is, it must not exceed four horses per beet row, if animal power is used. The device must pull and top all the beets and separate beets and tops, and leave the beets and tops convenient to load. It is especially understood that the work may be done by two machines, of which one does the topping, the other one the pulling or *vice versa*, although a combined machine is preferred. The pulling and topping must be done in a satisfactory manner. The beet puller and topper must be adjustable for rows spaced from sixteen to twenty inches apart. Damage to the beets or tops must be avoided as much as possible.

The selling price of the machine to the public by the local dealer, whether combined or otherwise, must not exceed $300 if the motive power is animal power and must not exceed $500 if belt-propelled.

Argental—A New White Metal

A Competitor of Silver.

A METAL or alloy, of very high-class qualities, has recently been evolved, after many years of research and experiments, by William A. McAdams. This new metal will be named "argental," because it is an alloy of silver and aluminium, the affinity of which is produced by chemicals and rare minerals, and it is par excellence as a substitute for silver having all its qualities except weight.

Argental has been produced to compete with silver, and for general manufacturing and industrial uses it is in many ways far superior to silver for the reason that, being alloyed with aluminium and cast by means of a patented compound and molds, or dies, it has many times greater strength than either silver or aluminum. It is white like silver and not leaden or blue like aluminium.

The silver in its composition prevents the aluminium from being attacked by ordinary alkalies, and the aluminium prevents the silver from being attacked by ordinary acids The alloy cannot be affected by nitric acid, and it will not tarnish or oxidize, by exposure to the atmosphere or gases. Its specific gravity is only one third that of silver, and consequently three or four times the quantity of manufactured articles can be produced from the same weight as that of silver, such as watch cases and movements, forks, spoons, bells, tableware, ornaments, hardware specialties, typewriters and similar machines, not mentioning a number of other incidental articles.

Comparing argental in weight with other metals, we find that it is one fourth the weight of copper, one fifth that of iron, one-fourth that of gold, and one sixth that of platinum.

The alloy can be cast, die-cast, rolled, spun, drawn into wire, milled, engine-turned, and turned in the best manner and the finest of threads cut on it. It takes a fine polish.

This metal is simply pure silver, alloyed with aluminium by means of chemicals and rare minerals. In the case of argental, the silver is alloyed with aluminium, in order to produce a neutral metal, which is proof against ordinary acids and alkalies, and also to gain great strength and lightness.

Notes for Inventors

A Bread Wrapping Machine.—In a recent issue of the SCIENTIFIC AMERICAN we stated that a machine was needed for wrapping bread in suitable paper. We are in receipt of a letter from the *National Baker*, of Philadelphia, informing us that such machines are well known.

A Packard Automobile Invention.—The Packard Motor Car Company as assignee of Russell Huff of Detroit, Mich., has issued patent No. 1,029,063, for a motor vehicle in which guards at the sides of the body extend to the rear of the body and a license plate is mounted on and directly above the rear extended part of one of said guards while a lamp is mounted on and directly above the extended part of the guard with one of its lenses facing the license plate so that the rays of light from the lamp will illuminate the license plate.

Two Hudson Maxim Patents.—Mr. Hudson Maxim has secured two patents, Nos. 1,028,472 and 1,028,473, for vessels of war. The vessel presented in the first patent has two oppositely disposed longitudinally extending water compartments for its immersion with inlets and outlets leading to the front and rear respectively and a propeller in proximity to the rear outlet; while the second patent is for a torpedo boat consisting of two hulls united longitudinally end to end with a war head carried by the forward hull and an auxiliary explosive head carried at the front of the war head.

A Machine that Demonstrates Varnishes.—In a patent, No. 1,029,223, issued to the Ohio Varnish Company of Cleveland, Ohio, as assignor of Walter R. Rae of Chicago, there is presented a demonstrating machine in which is combined means for automatically performing repeated cycles. These cycles include the application of the material such as varnish, the manipulation of such material, such for instance as to produce an effect illustrative of graining and then the automatic obliteration of the graining so that the apparatus can repeatedly produce to the eye the effects of the application and manipulation of the material in order to permit its use in advertising a particular material.

Rope Horseshoes.—An industry which might, it seems, be developed to advantage in this country, is that of rope horseshoes. These are largely used in Germany and some other foreign countries and should find favor here because of the large mileage of paved streets in most American cities. The rope portion is inserted in a metallic body or frame and in most instances provision is made for withdrawing a worn rope section and replacing it with a new one. In some instances the rope which is sometimes tarred has wire or other reinforcing material interwoven with it. Berlin is the headquarters of a syndicate composed of eight manufacturers located at different points of Germany. Possibly the practical development of the industry in this country would necessitate the modification of the shoe either in its metallic or rope portions or both to adapt it to local conditions.

Activities in Inventions. — Activities along certain lines of inventions result from various causes. Sometimes the demand creating the activity is local, at other times it is universal, while it is, at other times, produced by some peculiar condition calling for special results. Thus the large number of apartment houses has led to the activity in the class of automatic fire recorders for indicating the precise location of a fire within the area covered by the apparatus. Automatic telephones have experienced an impetus from the installation of phones in small series which do not warrant the expense of a "hello girl" exchange. Local conditions in California and Colorado, those great resorts for consumptives, have contributed largely to the insistent demands for antiseptic mouth pieces for telephone transmitters, many patents for such devices eventuating from applications filed from such States. This offers a field for invention which is practically as unlimited as that for individual drinking cups.

Legal Notes

Recent Adjudicated Patents.—Out of five adjudicated cases reported in the Patent Office Official *Gazette* of June 4th, 1912, only one patent was declared invalid. This was the design patent to Boldt, No. 39,921, for a bottle, and the U. S. Circuit Court of Appeals held this patent void on its face for lack of patentable novelty and invention. In the other four cases, three were held not infringed and one, the Truffault Re-issue patent, No. 12,437, for a shock absorber for vehicles, was held valid and infringed.

A Process After an Apparatus Interference.—In deciding *ex parte* Gold, Assistant Commissioner Billings referring to the question of *res adjudicata* said, "it is perfectly apparent that if the claims state merely the adjusting of the device so as to operate it in the way in which it was designed to be operated they are not separably patentable from the machine itself—in other words, that they are but different statements of the invention defined by the apparatus claims. It, therefore, follows that the judgment in the prior interference is a bar to the allowance of any claims the alleged method of which could be carried out by the apparatus in issue in that interference."

Securing Benefit of Foreign Application.—In the case of *ex parte* Barthels, Assistant Commissioner Billings has held that "Where an applicant claims the benefit of the filing of an application in a foreign country for the purpose of overcoming a reference, his affidavit, filed under the provisions of Rule 75, 'should be accompanied by a copy of the original foreign application, certified to by the Patent Office of the country in which it was filed, and if it is not in the English language, a sworn translation of the same or a translation made by the official translator of this office. If the application was not made by the inventor himself, applicant's affidavit should also state that the application in the foreign country was filed for his benefit and that such procedure is in accordance with the procedure in the foreign country.' "

Concealment of Invention.—Asst Com Tennant in the case of Quenzer v. Callis again indicates the danger of concealing an invention in the event of a contest arising as to priority. In this case the Board of Examiners in Chief held that in view of C's concealment of the invention, he had forfeited his right to a patent, and the Assistant Commissioner in affirming the decision of the Board quotes portions of the decision of the Court in the case of Warner v. Smith, 84 O G., 311, including the following: "Can one who has made an invention and who has locked it up in the secrets of his own exclusive knowledge and who produces it only when some rival inventor has entered the field be held to have acted in accordance with the policy of the law or with the spirit and purpose of the constitutional provision? Such action, or inaction, as we might more properly term it, not only contravenes the interests of the public, but also operates to injure the rival inventor who in the meantime enters the field of invention."

A Marconi Decision.—Mr. Chief Justice Shepard in the Court of Appeals of the District of Columbia has held that "When after the termination of an interference the losing party presented claims which were necessarily included in the scope of the decision in the interference and concluded thereby, it was the duty of the Commissioner to reject such claims."

The facts in this case are stated to be as follows:

"M filed two applications disclosing different species of the same invention; but in neither of them was the invention claimed broadly. After the declaration of the interference between the later application and an application of B, a patent was granted on the earlier application. The interference was decided in favor of B, and thereafter M sought to reissue the patent with claims broad enough to cover the devices disclosed in both of his applications. *Held*, that these claims were properly refused on the ground that M's right thereto was concluded by the decision in the interference."

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

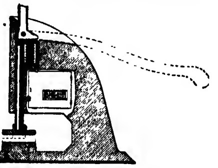
Of Interest to Farmers.

PLOW AND CHOPPER —C P BEAMES, Route 9, Carrollton, Ill The aim in this patent is to provide a machine especially designed for plowing up corn stubs and chopping the same with the stalks into small pieces or fragments, and scattering the same over the ground to be subsequently plowed in for fertilizing purposes.

COVER FOR PEACH BASKETS —I W. PECK, Bradentown, Fla This cover will prevent injury to the fruit from pressure, either external or internal, and by means of which the grower will be enabled to pack and ship his largest and finest fruit, and have the same arrive on the market uninjured by undue pressure from the cover or other crates stacked upon the crate in question.

Of General Interest.

REGISTERING SEAL PRESS – C D STAMPER, Williamsburg, Ky This invention has in view a press having associated therewith a register to indicate the number of impressions taken, the press and register being so combined as to secure simplicity of construction and insure the positive operation of the register, ac-



REGISTERING SEAL PRESS

cess to the latter being had only by the removal of a closure, ordinarily in the nature of a hinged door, which door is normally locked and sealed, and is to be opened only by the proper officer. The engraving shows a longitudinal vertical section through a registering seal press constructed in accordance with the invention

NON-REFILLABLE BOTTLE —W E GIROUD, 333 Decatur St, Brooklyn, N. Y, N Y Use is made in this invention of a valve mounted to travel in a spiral path in a valve casing, the valve having a spiral groove closed at its lower end when the valve is in lowermost position and is seated on the apertured bottom of the valve

NON-REFILLABLE BOTTLE

casing, the groove being open for the passage of the liquid at the time the bottle is tilted and the valve is off its seat The engraving of this improvement shows a sectional side elevation of the non-refillable bottle with the valve in closed position

GATE H C ANDERSON, R F D, Mount Vernon, Wash In the present patent the invention has for its object the provision of a single and cheaply constructed device, having means whereby it may be opened by persons on horseback or in vehicles without descending from the horse or the vehicle

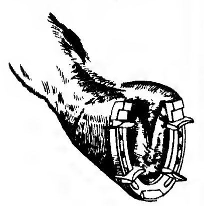
TORCH — J Z HANSON and R THORI, care of J Z HANSON, Aberdeen Idaho This invention relates to a torch particularly adapted for burning underwood or brush The torch is balanced to permit of ease in carrying the same, and a further object of the inventors is to provide a torch which will form a low forwardly-spreading flame in advance of the same

SPRING JOINT — W D TEUSTEN, 757 Macon St, Brooklyn, N Y, N Y This improvement relates to a form of spring joint that provides efficient means for housing the spring by which the joint is actuated, and the intention is to produce a superior joint which can be used in almost any relation where two parts are to be folded together

UMBRELLA - T SUSEMIHL and C P CARRINGTON, care of T SUSEMIHL, 1796 Fulton St, Brooklyn, N. Y, N. Y The more particular purpose here is to provide the umbrella with means whereby it may be disassembled and compacted into a small space and carried if desired in a small case for the purpose When spread

open and in active use, it assumes two distinct forms suitable for use under different weather conditions.

HORSESHOE.—A. M. H. De Bruycker, 173 Seventh Ave., Brooklyn, N. Y., N. Y. This inventor provides a horseshoe provided with detachable anti-slipping devices to permit the horse to obtain a sure foothold especially when going over icy roads, slippery pavements and the like. Use is made of anti-slipping calks ex-



HORSESHOE

tending transversely across the under side of the shoe and having upwardly-extending lugs engaging the outer and inner sides of the shoe, and transverse fastening pins extending through the said lugs and through the shoe to fasten the calks in place. The illustration pictures in perspective the shoe as applied to the hoof.

PASTEURIZING APPARATUS.—C. Paulsen, Copenhagen, Denmark. The characteristic feature of this invention consists in the very large heating surface employed in proportion to the size of the apparatus, and in the means provided for the good and thorough stirring which can take place, and lastly the ease with which the apparatus can be taken apart and cleaned.

NON-REFILLABLE BOTTLE.—L. Schaffert, 675 Knickerbocker Ave., Brooklyn, N. Y., N. Y. The inventor provides a bottle which cannot be refilled but will permit the ready efflux of liquid from the same. Another object is to provide a bottle in which it is difficult to obtain access to the means closing the same. And further to provide a bottle which cannot be opened by exhaust pressure.

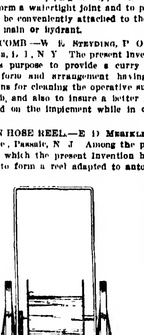
DEVICE FOR PREVENTING SPREAD OF EXPLOSIONS IN COAL MINES.—J. Cosavello, 1148 Penn Ave., Pittsburgh, Pa. In this patent the object of the inventor is to provide the chamber of a coal mine, in which coal is being dug, with a suitable device coöperating with the doors leading into the said chamber so that should an explosion occur in this chamber, the doors will be closed immediately.

Hardware and Tools.

HOSE LOCK.—O. V. Jackson, care of R. B. McCullough and R. L. Philips, Brunswick, Ga. In this invention the improvement relates to hose locks designed to unite the end of a hose to a section of piping or nipple in such a way as to form a watertight joint and to permit the hose to be conveniently attached to the end of a water main or hydrant.

CURRY COMB.—W. E. Steyding, P. O. Box 311, Mineola, L. I., N. Y. The present invention has for its purpose to provide a curry comb of simple form and arrangement having improved means for cleaning the operative surface of the comb, and also to insure a better grasp of the hand on the implement while in operation.

GARDEN HOSE REEL.—E. D. Meeikle, 308 Ayerigg Ave., Passaic, N. J. Among the principal objects which the present invention has in view are: to form a reel adapted to automati-



GARDEN HOSE REEL

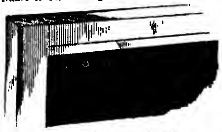
cally wind the hose as the reel is moved along the path of the same to avoid dragging the hose over the ground; to provide in a reel of the character set forth means for releasing the winding drum from the rotary mechanism therefor; and to provide means for holding the reel in upright position to serve as a sprinkling adjunct. The reel is shown in a front view in the illustration.

Heating and Lighting.

FURNACE FOR GAS GENERATORS.—F. J. Orr, 761 Prospect Ave., Buffalo, N. Y. This invention conserves the maximum units of heat by heating the walls and interior structure of the furnace to a radiating condition, which, after being raised to the necessary temperature, is there maintained by renewing the heat lost by radiation; and provides a conveyance of air and gas through the walls and structure of the furnace to produce the maximum affect.

Household Utilities.

FLY ESCAPE FOR SCREENS.—H. W. Welty, 416 E. 40th St., Chicago, Ill. The intention in this case is to provide a screen for doors and windows of buildings so constructed as to permit the escape from the building of such flies and other insects as may be upon the inside and yet effecinally prevent the entrance to the building of such flies and insects



FLY ESCAPE FOR SCREENS

as may be on the outside. The screen comprises a frame of the usual form and of any usual or preferred material. The accompanying illustration provides a perspective view of a portion of a door or window screen embodying the invention and looking at the outside thereof.

BRACKET.—W. Piplowski, 414 Bedford Ave., Brooklyn, N. Y. Among the principal objects which the invention has in view are: to provide brackets adapted for installation without marring the trim or finish of a door or window opening. It is to obviate a number of objections that the present brackets are provided with means for securing them to the trim different from that heretofore employed.

Machines and Mechanical Devices.

BELT SHIFTER.—E. J. Egan, Winchester, Ky. This invention has for its object the provision of a simple and positively operated mechanism for use in shifting a belt on stepped cone pulleys, wherein the shifting mechanism is supported on a traveling carriage, operated by a traveling cam.

DITCHING MACHINE.—N. W. Griesler and A. G. Griesler, R. F. D., 4, Van Wert, Ohio. The purpose here is the provision of a device which will remove the soil by layers, until the ditch is completed, and which will be entirely automatic in its action, and wherein a grinding means is provided for constraining the machine to follow the ditch.

MACHINE FOR PILING TEXTILE FABRICS.—C. J. Priester, 25 Bleecker St., New York, N. Y. Among other provisions this invention provides means for supporting and depositing devices, rods, or other retaining means for holding the fabric at each end of the lay performed by the machine, provides means wherein anchoring devices for holding the cloth at the ends of the lay are carried, and from which they are automatically fed; provides means for feeding cloth to a cutting table to prevent trapping the air between layers of cloth to disturb regularity of the lay; provides for guiding cloth from the piling machine to the lay, provides receptacles for the cloth-anchoring devices and adjustable means for feeding cloth therefrom when delivered in bolt or plied form.

FLEXIBLE COUPLING.—W. J. Francke, care of John Waldron Co., New Brunswick, N. J. In the present patent the improvement has reference to shaft couplings, and the purpose is to provide a new flexible coupling arranged to insure proper transmission of the power from one shaft to another even should such coupled shafts be out of line or out of center.

MACHINE FOR CUTTING SLICES OF BUTTERED BREAD AND SANDWICHES.—S. A. Gage, 13 Rue de Presbourg, Paris, France. This invention relates to a machine for the production either of slices of buttered bread or of sandwiches, the machine being so constructed that the two pieces of bread shall be of the same thickness and the slices of buttered bread or sandwiches, as the case may be, delivered in a continuous way.

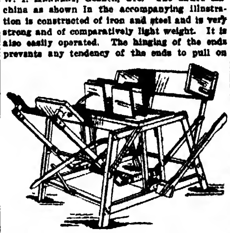
ROCK GATHERING AND EXCAVATING MACHINE.—D. A. Gilchrist, Belgrade, Mont. Draft animals may be attached to this machine, and it is constructed so that it may be operated automatically when advanced by the horses to pick up rocks lying at or near the surface of the earth. A special arrangement is made for adjusting the device to this work, and scoop attachments are provided for use to transform the machine into an excavator.

CENTRIFUGAL PUMP OR BLOWER.—M. Neumayer, care of W. C. Green, 506 Bell Block, Cincinnati, Ohio. This machine is simple in construction and rendered very effective in operation by the use of a special runner and a plurality of suction chambers, so that the fluid passes through the machine in stages with increasing velocity, finally leaving under a desired pressure and predetermined delivery capacity.

SAFETY FIRING ATTACHMENT FOR BREECH LOADING RIFLES.—F. Hartsuy, Field Hospital No. 2, Presidio of San Francisco, Cal. This invention relates to rifles for sea coast *defense* and mounted on disappearing carriages. The aim is to provide an attachment for breech-loading rifles, arranged to prevent firing of the loaded gun until the latter is raised in firing position, thus preventing premature discharge of the gun into the projecting parapet.

CLOTH LAYING MACHINE.—A. H. Van Devander and J. E. Moore, care of H. Van Devander, Cedartown, Ga. This machine will stack superposed layers of cloth in predetermined lengths in a smooth and even manner, with the least possible effort on the part of the operator. The machine can be used to lay different lengths of cloth and stack them by hand or power, in a pile on an adjustable cloth receiving member.

CEMENT BLOCK AND BRICK MACHINE.—W. I. Kennedy, Goshen, Ore. The entire machine as shown in the accompanying illustration is constructed of iron and steel and is very strong and of comparatively light weight. It is also easily operated. The hinging of the ends prevents any tendency of the ends to pull on

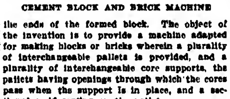


CEMENT BLOCK AND BRICK MACHINE

the ends of the formed block. The object of the invention is to provide a machine adapted for making blocks or bricks wherein a plurality of interchangeable pallets is provided, and a plurality of interchangeable core supports, the pallets having openings through which the cores pass when the support is in place, and a sectional mold resting on the pallet.

METHOD OF PERFORMING OPERATIONS INCIDENTAL TO MACHINE EMBROIDERY.—H. Bosshardt, 8a, 955 Hill St., Hoboken, N. J. This invention relates particularly to a method of forming a combined color filled and embroidered fabric where figures are stenciled on the fabric instead of forming said figures by means of color covering or leaf stitch and more particularly to a method of pantographically forming a duplication of the figures on a pattern blank and in forming outlining stitches bounding said figures after they are stenciled on the fabric.

CENTERING DEVICE.—F. L. Wheeling and F. A. Rogers, 746 Lake St., Los Angeles, Cal. This device is for use on lathes and similar machines, and more especially for centering "offset" work such as crank and cam shafts, valve eccentrics, etc., arranged for keeping the work in one center while one or more cranks or cams are being turned. For this purpose, use is made of a face plate attached to and



CENTERING DEVICE

rotating with the head stock spindle of the lathe, a tail stock face plate mounted to rotate on the tail stock spindle, and work-carrying means adjusted laterally on the said face plates, for supporting the ends of the work eccentrically to the axis of the spindles. The engraving shows a rear view of part of the lathe with the centering device, and showing a crank shaft for turning the cranks thereof.

WORD COUNTING ATTACHMENT FOR TYPEWRITERS AND TYPESETTING MACHINES.—E. F. Goin, Nardin, Okla. This inventor has in view a compact registering appliance applicable to any typewriting or typesetting machine, and readily thrown into and out of operation, as well as reset, by depressible keys. Thus the working of the counting device can be carried on the same as if it formed a part of the key-operated mechanism of the machines.

Prime Movers and Their Accessories.

INTERNAL COMBUSTION ENGINE.—Dr. R. H. Powell, Grafton, W. Va. The objects here are to provide a device by means of which the scavenging of the engine may be effectively accomplished; a device in which a higher compression is secured; a means for cooling the piston and the cylinder; a device in which the carbon deposit on the piston and cylinder is reduced to a minimum, due to complete combustion; and a device capable of using a longer stroke.

Railways and Their Accessories.

BRAKE SHOE ADJUSTER.—[illegible] worth, Box 124, [illegible] This invention has for its purpose to provide a simple apparatus which may be used on car trucks either with outside or inside brake beams for automatically adjusting the position of the brake shoes relatively to the wheel, to take up the slack caused by wear.

RAILWAY SWITCH.—C. E. [illegible], Livingstonville, N. Y. This positively-acting device is operable from the street car, the switch being thrown by the motorman to either of its positions by depression of an operating member carried by the car, the member in each instance at either side of the switch working one of the two aligning operating cams as the car passes thereover, which cams are rapidly connected and ordinarily arranged between the rails, one of these cams being thrown up to operative position when the other is depressed to throw the switch.

Pertaining to Recreation.

BUBBLE BLOWER.—F. H. Coustrueren, 88 Greenpoint Ave., Woodside, L. I., N. Y. This inventor provides an apparatus the operation whereof results in the formation of a plurality of soap bubbles, one contained within the other; and provides means contained within the apparatus for insuring the formation of the bubbles in the prescribed manner and correlation.

Pertaining to Vehicles.

RESILIENT VEHICLE WHEEL.—H. J. Sheedy, care of J. E. Schlager, Stewart Packing Co., Scranton, Pa. This wheel has a hub and a rib member spaced therefrom and disposed thereabround, there being recesses in the hub and in the rib member for receiving projections on pneumatic members, which are disposed between these members, the pneumatic being reinforced by rods having threaded terminals projecting through terminals of the pneumatic members, and which are engaged by nuts pressing the terminals of the pneumatic members against shoulders on the rods, the nuts engaging neighboring nuts.

SPRING TIRE FOR VEHICLES.—S. B. Crews, Tampa, Fla. This invention has for its object the provision of a practical, efficient, and durable spring tire for autos and other motor vehicles in which metallic springs are substituted for pneumatic pressure. The invention applies a punctureless tire having the same elastic quality as the more expensive pneumatic tires now generally used.

PUMP FOR AUTOMOBILE ALARMS.—W. H. Garlock, P. O. Box 686, Seattle, Wash. This device is for use in compressing air to sound an alarm. It is capable of being operated by hand or foot of the driver, and may be applied to vehicles of any construction without change in the vehicle itself, and wherein the operative parts are thoroughly protected from weather and external violence.

Prime Movers and Their Accessories.

OSCILLATING VALVE.—J. W. Davis, care of C. G. Hall, Box 349, Whitefish, Mont. This invention relates particularly to oscillating valves for locomotives, and to means for permitting the engine to run free when the valve is shut off. It automatically connects the intake and exhaust ports of the cylinder when steam is shut off so that the piston may freely move without creating any back pressure.

ROTARY PUMP.—R. H. Danner, 414 E. 64th St., Los Angeles, Cal. The object here is to provide a new and improved rotary pump, more especially designed for use in bored or driven wells, and arranged to prevent the bearings of the pump shaft from being cut by sand or other extraneous matter.

Designs.

DESIGN FOR A BADGE.—Mary F. Slattery, care of Mr. Cowan, 1418 Fifth Ave., Manhattan, N. Y., N. Y. This ornamental design embodies the Irish emblem of the shamrock and the snake, the animal lying obliquely across the stem and partly on the two lower leaves.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12655) "A Reader for Ten Years" has asked us as to the most modern method of making gelatine sheets, and what machinery to use, etc. We must emphasize the fact that we do not answer anonymous communications. All letters must contain full name and address of writers.

(12656) T. S. S. asks: Has there ever been any way discovered to make rain by artificial action? A. There is no proof that any rain has been produced artificially, or when rain would not have fallen by natural causes. The U. S. Weather Bureau has many times said this. It is very unlikely that any shock can be given to the air by exploding powder to cause the condensation of moisture to rain, since thousands of cubic miles are involved in even a moderate storm. This topic is treated in Milham's "Meteorology," a new book, which we send for $4.50.

(12657) We very frequently receive the question, "Is the Mississippi River higher at its mouth than it is at its source?" A correspondent recently criticised our saying that the river is farther from the center of the earth at its mouth than it is at its source, and also that it ran down hill all the way from its source to its mouth; that is, the source is higher above a water level than is its mouth. Both of these statements are true, and we propose to discuss the matter more fully. There are two points involved in the question: the figure of the earth, and the relation of the river at points along its course to the level of the sea. First, the figure of the earth. Those who would read a *résumé* of this subject will find a clear statement given in the Encyclopedia Britannica, eleventh edition, vol. 8, pages 801-813. The figure of the earth is defined as "the surface of the sea imagined to percolate the continents by canals." It is therefore a water-covered surface along what is called the sea-level. Mathematically it is an ellipsoid of rotation, as shown by Laplace in his "Mecanique Celeste," and, in English, by Sir George Airy in "Mathematical Tracts," and many others, among whom we will name Sir George H. Darwin, the son of Charles Darwin, and not less illustrious in mathematics than his father in biology. The generating ellipse is rotated upon the polar axis of the earth, which is also the minor axis of the ellipse. To determine this ellipse numerous measurements of arcs of meridians have been made in various parts of the earth, from the equator to Hammefest beyond the Arctic Circle. The results are discussed by A. R. Clarke in the "Comparisons of the Standards of Length" in 1866, and in his "Geodesy" in 1880. The conclusions reached are that the equatorial semi-diameter of the earth is 20,926,202 feet, and the polar semi-diameter is 20,854,895 feet. These are the dimensions of the earth employed by astronomers and geodesists in their computations, and they may be relied upon as having but a slight probable error. It is thus seen that the equatorial semi-diameter is longer than the polar by 71,307 feet, or 13.504 miles very nearly. It is upon this that the statement usually made is based that the equator is 13 miles farther from the center of the earth than are the poles. And thus it is that a river running toward the equator in either hemisphere is rising farther and farther from the center of the earth as it flows over the surface of the earth. We referred this question to the U. S. Coast and Geodetic Survey and received from them the following data: "The distances from the center of the earth to points on the spheroid (that is, the average sea-level surface of the earth), using approximate latitudes, are as follows. Mouth of the Mississippi River, lat. 29 deg. 00 min., 6,373,159 meters. Source of the Mississippi River, lat. 47 deg. 10 min., 6,366,524 meters." Reducing the difference between these two numbers to miles, we find that the mouth of the Mississippi River is 4.12 miles farther from the center of the earth than is its source. Doubtless most of our readers understand that this figure of the earth has resulted from the centrifugal force of its rotation upon its axis, while yet plastic in its early history, producing the equatorial ring about 13.5 miles deep. Along this surface water will not flow. It is the water level of the ocean. If the source of the Mississippi River were 4.12 miles nearer the center of the earth than its mouth is, there would be no flow of water in its bed from the source to the Gulf. We may also point out that it is along this water-level surface that a ship sails on the ocean. If a ship could sail from the pole to the equator, it would at the end of the voyage be 13.5 miles farther from the center of the earth than when it started from the pole; and yet it would have sailed along a water-level surface all the way. A ship does not sail up hill in sailing [illegible] miles up hill in running from Lake Itasca to the Gulf of Mexico. It is raised to that height by the earth's rotational velocity. This brings us to the second point in the question, the altitudes of the river at various places along its course. "Higher" of course refers to altitudes above sea level. Here we have recourse to the excellent "Dictionary of Altitudes," compiled by the U. S. Geological Survey, fourth edition, 1906, and give the heights of extreme low and high water for several places, with the dates when these heights occurred:

Place.	Low, feet.	Year.	High, feet.	Year.
New Orleans, La.	1	1888	15	1882
Red River, La....	6	1872	52	1882
Vicksburg, Miss...	42	1872	94	1884
St. Louis, Mo ...	379	1844	414	1888
St. Paul, Minn ..	683	1878	702	1881

Lake Itasca, Minn., altitude 1,664 feet.

If we take the figures for extreme low water, it is evident that the Mississippi River falls 1 foot in the 106 miles from that city to the Passes at its mouth; and that it falls 6 feet in the 310 miles from the Red River to its mouth; and that its total fall from the source to the Gulf is 1,664 feet. As we said in our former answer to Query 12618 to which exception was taken, "The Mississippi River flows down hill all the way from the source to its mouth, which means that the source is higher above a water level (which is sea level) than the mouth is. Water does not anywhere on the earth run up hill [except under pressure in closed channels] nor along a water level. It can only run from a higher level to a lower level."

(12658) G. P. G. asks: Suppose that we have two electrical resistances, equal when hot, and in series, so that they will each absorb the same amount of energy. Let one resistance take the form of say a tungsten lamp, so that it will emit the largest possible amount of light. Let the other resistance be composed of such a length and thickness of say iron wire that it will be only black hot. Here we have two resistances each transforming the same amount of electrical energy, the first into light and heat and the second into heat only. Query Will the number of thermal units liberated be the same in each case?—a thermal unit being that amount of heat necessary to raise 1 pound of water 1 deg. Cent. If you answer "Yes," it is evident that we get the light for nothing, which is not thinkable, and I would ask, is there any theoretical limit to the amount of light that may be produced from a given number of watts? A. We must answer your question that the heat generated is the same when the current and resistance in two circuits of the same metal are the same, for the same length of time. The formula is

$$\text{Calories} = 0.24\ C^2Rt \text{ in seconds.}$$

That a part of this radiated energy is of a short wave length which can affect the eye as light when it happens to enter an eye, but the rest is of such long waves that it only affects us as heat and does not affect the sum total of energy radiated at all. Heat and light are not two energies, but one appreciated by different senses. The same waves which affect the retina as light would, if they impinged upon the skin, affect the nerves by which the sensation of warmth is produced. The energy is not light till it affects the optic nerve, nor heat till it is perceived by the proper sense. It is not a case of getting anything for nothing. We get so much radiant energy That portion which we use as light we do not use as heat, and *vice versa*. We know no theoretical limit to the watt value of a candle. The arc lamp produces a candle for the least electrical energy. What can be done to reduce this cost we cannot say.

(12659) C. V. H. asks: In your number of April 27th you stated that any object which does not float at the surface will not float at any depth. What is, then, the reason that divers use lead boots and other weights in order to sink and keep their balance in underwater wrecking operations? A. Divers use lead weights upon their feet to sink them, because otherwise they would float and not sink at all. The air within their rubber suits would prevent them from going down. The weights are heavy because they need to push and work at the bottom, and unless they have a heavy weight they would have no power to do any work, but would be moved about by the slightest pressure against any object. They could not even walk about The weights on their feet are much greater than are required to sink them.

(12660) W. C. R. says: I observe that in the case of the "Titanic," as of other steamers that have foundered, it is stated that when the vessel sank the boiler exploded. I can understand that a mass of water rushing in upon the fire would create a vast amount of free steam, but should that have to do with pressure in the boilers, which one would expect to be lessened with the extinguishment of the fire? A. The sudden entry of water into the furnaces would generate large quantities of steam, which would rush up the uptakes and smokestacks. This and the roar of the escaping steam might lead to the belief that the boilers had exploded. The cold water would tend to condense the steam in the boilers and reduce the pressure.

(12661) W. H. J. asks: To what depths have divers gone? A. The "Encyclopedia Britannica," vol. 8, page 329, states that the greatest depth at which useful work has been done is 182 feet. A Spanish diver recovered silver from a wreck at this depth. Sponge fishers dive to a maximum depth of 150 feet, and the pearl fishers go to about 120 feet. The SCIENTIFIC AMERICAN, vol. 106, No. 22, gives the account of a submarine going to a depth of 300 feet.

NEW BOOKS, ETC.

THE NEW NAVY OF THE UNITED STATES. By N. N. Stebbins. Introduction by the Admiral of the Navy, George Dewey, U. S. N. 150 half-tone illustrations. New York: Outing Publishing Company. Price, $1.50.

Printed descriptions can do much in describing a warship, but a photograph or a drawing can do much more. It was with this conviction that the author of the present excellent work, who is a marine photographer by profession, has gathered together a series of photographs taken during the past twenty years by himself of the ships of our new navy. The author, whose studio is in Boston, was particularly well situated for the task, for the reason that of late years most of the trials for speed of our warships have been carried on at Rockland, Maine, and Mr. Stebbins has made a point of being present and taking photographs of the ships on their full-speed trials, whenever it was possible. In the early pages are to be found some excellent views of the older ships of the navy, including the "Constitution" of 1797, the "New Hampshire" of 1817, and the "Hartford" of 1858. The new navy dates from the early eighties, and the photographs include some excellent views of the ships of the celebrated "White Squadron," such as the "Boston," "Atlanta," and "Chicago." The later ships follow pretty much in the order of their construction, and the last views include such late ships as the "Florida" and "Utah." Also there will be found reproductions of wash drawings of the battleships "New York" and "Texas" and "Wyoming" and "Arkansas" now under construction, and a deck plan of the "Nevada" and the "Oklahoma." The list of views includes the colliers, the converted yachts, and the cutters of the Revenue Service Capt H. Uberoth's article on the Revenue Cutter Service is one of the most attractive features of the work.

EFFICIENCY AS A BASIS FOR OPERATION AND WAGES. By Harrington Emerson. New York: The Engineering Magazine, 1912. 12mo.; 254 pp. Price, $2.

THE TWELVE PRINCIPLES OF EFFICIENCY. By Harrington Emerson. New York: The Engineering Magazine, 1912. 12mo.; 423 pp. Price, $2.

If American industry, judged by easily attainable standards, is only thirty per cent efficient, then the sooner American industry awakes to the situation, the better for all concerned. Are we wasting nearly seventy per cent of our time, energy, and money? Could a few changes in industrial administration abolish the bread line and the necessity for feeding seven hundred starving children at the East Side schools, and incidentally place the United States in a position where she need not rely upon her exceptional but failing resources for commercial pre-eminence? Eliminate this seventy per cent of waste, says Mr. Emerson, and men may work less laboriously, receive higher wages, and deliver a better and cheaper product The works exhibit a masterly command of facts and illustrations They are broad and humane without being vague, keen and precise without being narrow, and they compel the most serious consideration When manufacturing plants, railway repair shops, and building operations are shown by reliable statistics to be carried on in so wasteful a way, certainly the remedy offered should be thoughtfully studied. It is not an untried experiment, but a plan that has already spelled success in many instances Briefly, it is to furnish the old-line organization with standards, and to supplement it with staff organization The line should no more resent this aid than—as Mr Emerson has it in one of his happy illustrations—the commander of a submarine resents the squeaking of the mouse that warns him of the presence of dangerous gases. The author proceeds to show the application of staff and standards to a typical shop Five surveys are run to determine the condition of machines and tools; the relation between what men are actually doing and what they should do; the relation between current costs and standard costs, the speed of movement of work through the shop, and the degree of efficiency in handling and checking materials The old method of finding costs after completion of the work, is superseded by the new method of anticipating them; in fact, predetermination of results is the main characteristic of the new method on the cost accounting side It is claimed that "the efficiency system" has resulted in reducing locomotive repair cost from eight cents, ten cents, and even twelve cents per mile to six cents, and that in other activities the reduction in expense has been as sweeping and extraordinary In "The Twelve Principles of Efficiency" the system is further amplified and expounded, and its claims substantiated by citations of actual accomplishments. In short, we must characterise these as two remarkable books whose every word is worthy of careful study and whose tenets demand the most careful test.

SOAP BUBBLES. Their Colors and the Forces Which Mold Them. By C. V. Boys, F.R.S. New York: E. S. Gorham, 1912. 16mo., 190 pp.; illustrated. Price, 85 cents.

"Soap Bubbles" is a series of most fascinating experiments bearing upon the elastic skin of liquids, capillary attraction, the tension and curvature of soap-films, and the color, thickness, and possibilities of soap bubbles The substance of the book was originally delivered in the shape of popular lectures before juvenile audiences, and serves admirably to awaken the youthful mind to the marvels of natural phenomena, and to incite it to further and more serious study.

CONSTRUCTING CONCRETE PORCHES. By A. A. Houghton. New York: The Norman W. Henley Publishing Company, 1912. 59 pp.

CONCRETE BRIDGES, CULVERTS, AND SEWERS. By A. A. Houghton, 132 Nassau Street, New York: The Norman W. Henley Publishing Company, 1912. 55 pp.

These two books may be commended for their clear, concise discussion of important phases of concrete construction

TEXT-BOOK OF PHYSICS. By C. E. Lineberger. Boston: D. C. Heath & Co., 1911. 12mo.; 471 pp.; illustrated.

As an elementary text, written for the average student, appeal is first made to any knowledge of the topic which the average student may be expected to possess, definitions are as crystallized as it is possible to make them, what little apparatus is used is carefully set forth in explanation and illustration, principles are concretely applied, and problems of moderate difficulty, calling for constructive reasoning, are furnished in abundance The arrangement of material is sound, and its variety and attractiveness commendable

METEOROLOGY. A Textbook on the Weather, the Causes of its Changes, and Weather Forecasting, for the Student and General Reader. By Willis Isbister Milham, Ph.D, Field Professor of Astronomy in Williams College. New York: The Macmillan Company, 1912. 8vo., xvi, 549 pp.; illustrated. Price, $4.50.

Meteorology has had a long struggle for recognition as a suitable subject for the university curriculum in this country Why this is so it would be difficult to say, in view of the fact that weather is a subject of universal interest. However, the anomaly of the situation appears to have been brought to the attention of academic authorities, and within a few years past courses in meteorology have been introduced at a score or more of our institutions of higher education A suitable textbook for these courses was an urgent desideratum, which Prof Milham has happily supplied in the treatise under review. Since the publication of Prof Loomis' now antiquated, but still highly useful, "Treatise on Meteorology," no work on this subject has appeared in the English language at all approaching Prof Milham's book in its availability for use in the college classroom Let us hope that some one will soon supply the equally pressing want of a textbook for high schools to replace the obsolescent elementary treatises of Davis and Waldo.

As a textbook, Milham's book may be compared with the second, condensed edition of Hann's "Lehrbuch der Meteorologie," than which it is more comprehensive, but less thorough Thus, Milham covers several important topics that Hann completely ignores, e g , meteorological instruments, weather prediction, and atmospheric optics On the other hand, for rigorously scientific explanations of atmospheric phenomena in the light of modern investigations, Milham's treatise can by no means be accepted as a substitute for the great German authority, and the teacher who uses Milham's textbook in his classes will need to have at hand both editions of Hann for constant reference On the descriptive side, Milham is adequate, but on the theoretical side rather superficial, and sometimes inexact.

For the general reader, Milham's book may be recommended as a compact body of up-to-date information It is especially to be commended for its cosmopolitan outlook. As a rule, an American work on meteorology is apt to be too American, and an English work too English, but Milham has drawn his information from all available sources, and especially from the rich storehouse of German science.

As to make-up, each chapter begins with a useful syllabus of its contents, and closes with collections of questions on the text, topics for investigation, practical exercises, and references; all of which is in accord with the best pedagogic practice The appendix contains a copious classified bibliography Charts, pictures, and diagrams are numerous and generally excellent, though the charts would have been more instructive if coloring had been more generously used. This is a point in which American textbooks suffer in comparison with German

This book has one serious blemish, which we feel it our ungrateful duty to point out—in the spelling of foreign words and names, with which the book naturally abounds, flagrant errors occur by the score We must hold the author responsible for the bungling of personal names with which the publishers' staff could hardly be expected to be familiar, as "Dové" for "Dove", "Mühy" for "Mühry", "Fisher" for "Fischer", "Lemstron" for "Lemström", "Edward Buckner" for "Eduard Brückner", etc.; but author and publisher are jointly to blame for the numerous egregious blunders in the spelling of everyday French and German words entering into the titles of the works listed in the bibliographies, such as "Erganzungscheft" for "Ergänzungsheft", "atmospherische" for "atmosphärische"; "practique" for "pratique", etc The number of such errors in the otherwise excellent bibliographies is truly appalling.

V.—Shall My Boy Become a Chemical Engineer?

By M. C. Whitaker, Professor of Engineering Chemistry, School of Chemistry, Columbia University

[This is the fifth of a series of articles intended to set forth fairly the business possibilities of the technical professions. The articles are prepared by men who are connected with the more important technological institutions of this country and who are for the most part prominent educators. Because these teachers have instructed hundreds of young men in the principles of engineering, they are best qualified to write upon a subject so immensely important in the future development of American manufacturing industries.—EDITOR.]

THE industrial progress of a nation depends primarily upon the skill and inventive talents of a certain portion of its population. The natural resources of a country may be exploited by a foreign people, but the national benefits from a true industrial growth can come only from native initiative. Industrial wealth increases as a result of research and discovery, and all developments not based on solid scientific knowledge are unstable and soon become undermined.

The first requisite for permanent industrial growth, therefore, is a class of leaders of thorough scientific training combined with a natural or acquired talent for developing applications. Advancement in the science and the art of mining, railroading, electrical applications and mechanical developments is necessarily solely dependent upon such a body of men. The more thorough and complete the training, the greater will be the facility with which they handle the inevitable new problems arising in their work, and the greater will be their contribution to the profession of engineering, and to permanent industrial development.

Schools of mechanical engineering have for forty years met the demands for men to develop the innumerable applications of mechanical principles and physical laws, and the graduates of these schools are engaged all over the country in designing, building and operating appliances for the utilization of power and the transformation and application of energy. The effect of their work may be seen in the development of the multiple expansion steam engine, gas engine, steam turbine, transportation machinery and innumerable other mechanical applications.

The education of men for the applications of electrical energy has kept pace with the development of the dynamo, the motor, the telephone and the telegraph, wireless telegraphy, etc. Our railroads, buildings, bridges and municipal works are directed and developed by the products of numerous schools of civil engineering. No one would question the wisdom of the establishment of schools to provide the training for these engineers. The scientific and industrial development in their respective fields has amply justified the existence of such schools and the demands for their graduates are constantly increasing.

There still exists, however, a branch of engineering, the scope and possibilities of which are greater than all of the others combined, and that is the field of manufacture involving the principles of chemistry. The value of the chemical products manufactured in the United States during the last year aggregated over $8,000,000,000. The development of the men to build up, manage and operate the numerous units going to make up this great industrial division has, until recently, been largely a hit and miss matter.

Who is best equipped to design, build and operate our factories and processes founded on chemical principles? Certainly not the electrical engineer, educated to work around the pivotal point of electrical theory and with little or no knowledge of chemistry. Certainly not the mechanical engineer, specially trained in the development, use and application of power and energy; nor the civil engineer, educated in the theory and practice of construction; nor the mining engineer, educated to win the raw materials from the earth. Among the classes enumerated, we find only those who are specialized in the recovery of raw materials and those trained to make applications of the finished products. The intermediate step—that of manufacture—has been entirely omitted. Our failure to recognize the need and to provide men trained in the application of engineering methods to chemical problems is amply illustrated by reference to the history of a number of our noted developments. The chemistry of the Solvay soda process was available for thirty-five years before the engineering difficulties were solved. Our present water gas system lay dormant for fifteen years before engineering talent could make it commercially successful. The principles on which the wonderful contact process for sulphuric acid is now operating, were well known to the chemist for many years before the indispensable chemist-engineers were found to solve the large scale applications. The electro-chemical principles published by Faraday lay fifty years awaiting the development of the mechanical and electrical appliances needed to perform the chemical functions. The European monopoly of the world's supply of sulphur was broken by a man who had the courage and skill to engineer well-known physical and chemical principles and thus create a new American industry.

In the other engineering branches there is usually a prompt application of newly discovered principles, but in the chemical field there is often a long delay between the publication of a new idea and its successful industrial application. Innumerable illustrations might be cited to show the lack of correlation between the science of chemistry and modern engineering development. If the principles followed in the training of mining, civil, mechanical and electrical engineers are correct, and their results seem to justify this conclusion, the field of chemical manufacture has been sadly neglected, and the difficulties experienced in the upbuilding of many of our now successful processes have been due to a scarcity of men trained in the special field of chemical engineering.

Other engineering developments are already being hampered by unsolved chemical problems. Some of these problems remain unsolved from lack of knowledge, some from lack of resources to pursue the necessary investigations on an illuminating scale, and others from the failure to centralize engineering resources around the focal chemical point. Railroad engineers are demanding improvements in the chemical composition and manufacture of steel to reduce the number of catastrophes occasioned by the rapid increase in the speed and weight of trains. Disintegration of structural materials like cement and steel are hampering engineering development, and chemical manufacture itself is handicapped by a lack of refractory metals and materials. Fuel problems, food problems, illumination problems, problems involving the conservation of life and property, are becoming more pressing as a result of the advance of general engineering. In almost every one of these difficult and important problems, the solution will come through a better knowledge of chemistry and its applications.

Some of our leading institutions are fully alive to the importance of chemical engineering as a profession and are providing excellent courses of training both in the fundamental sciences and also in the study of the applications. These chemical engineering courses require new and expensive laboratory equipment quite different in kind from that heretofore used in engineering school instruction, and infinitely more varied in its scope. The development of great laboratories of engineering chemistry will naturally offer the best facilities for the investigation of great industrial problems. In such schools, men with a knowledge of the theoretical sciences may be taught the best applications known to the combined engineering profession.

INQUIRY COLUMN

Inquiry No. 9264.—Wanted, the name and address of manufacturers of Gate Fitting Machines.

Inquiry No. 9265.—Wanted, names and addresses of manufacturers of machinery for making picket fences.

Inquiry No. 9266.—Wanted, to buy machinery for fastening wire cloth to wooden frames with coppered tacks.

Inquiry No. 9267.—Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9273.—Wanted, to buy a globe for a parlor fountain, working on the Hason system.

Inquiry No. 9274.—Wanted, the name of a manufacturer of a machine to make cushion covers for [illegible].

Inquiry No. 9275.—Wanted, name and address of manufacturer of stock patterns of platen job printing presses.

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00.

Inquiry No. 9277. Wanted. A machine for [illegible] dry [illegible].

Inquiry No. 9278. Wanted. A machine for [illegible]

Inquiry No. [illegible]. Wanted. A machine for [illegible]

The Annual Convention of the Master Car Builders' Association

By Reginald Gordon

THE annual convention of the Master Car Builders' Association was held at Atlantic City, N. J., June 12th to 14th, inclusive. The deliberations of this body of practical railroad men are always productive of matter of great value to the transportation world, especially in this day of large, heavy, steel cars, increasing rate of wages and always closer supervision by State and national commissions. There is a marked tendency among the various technical, railway and manufacturers' associations, of which there are many now in existence, to work together in the investigation and solution of the new and increasingly complex problems that arise from time to time in the economical operation and maintenance of railways. A large proportion of the membership of these societies is composed of technically educated men, whose opinions and decisions on questions relating to their respective departments of a railroad are of great value, involving, as they do, the expenditure of millions of dollars annually for labor, new materials and supplies.

After the address by the president of the M. C. B. Association, reviewing the work done during the past year, and the general progress made in car construction, the convention listened to a report upon specifications for cast and rolled steel wheels for cars. The experience gained during the past few years with the wheels used on 50-ton capacity coal and ore cars has shown the necessity of establishing rigid specifications governing the chemical composition, method of manufacture and mode of testing of steel wheels intended for that kind of service. While the majority of wheels in use under freight cars are of chilled cast iron, a kind of wheel that has given years of satisfactory service in the United States and Canada, many railroad men now distrust its margin of safety under modern conditions with heavy loads, which in the case of a loaded car means a weight of 37,000 pounds carried on every one of the four axles. The effect of bad track, the brittleness of the material at the low temperatures that are common above the 40-degree parallel of latitude, and the excessive heating caused by the brake shoes applied to the wheels on long descending grades, require a wheel that is very strong, hard and tough in its characteristics. The steel wheel costs more than that of chilled cast iron at first, but its dependable period of service is longer. Nevertheless, there were many members at the meeting who advocated the continued use of cast iron wheels, having found them satisfactory for all kinds of freight service; particularly on account of the low first cost and the guarantee by the manufacturers of a definite life or mileage, in addition to an allowance for scrap value when worn to the limit of safety. The wheel makers also are willing to furnish a cast iron wheel guaranteed for use under cars of 70 tons capacity; but as yet there are only a few of the latter, for special service such as the transportation of bridge members, large castings or heavy guns.

A very timely discussion was held on the inspection of box cars, with particular reference to the transportation of their contents without loss or damage. At all important divisional points, freight cars are inspected in the running gear, couplers and air brakes, in order to determine whether the cars are fit to run. An examination of the roofs and doors for leaks; of the floors to determine whether there is any oil, lime, acid or any other wet or corrosive substance that would damage certain classes of goods; or of the sides and ends for the removal of projecting nails, splintered boards, etc., is seldom thoroughly done. Then again, many cars are sent out loaded but so insecurely fastened that the theft of their contents is an easy matter and one that is constantly occurring. The members agreed that much more detailed inspection of cars is needed, as is evidenced by the enormous sums of money constantly paid out by railroad companies in settlement of claims for loss and damage of goods

in transit. They also urged upon all their fellow members the serious consideration of stouter construction, better materials and more frequent inspection of all parts of box cars in order to reduce the loss from the causes mentioned.

Owing to the increasing variety of the distillates of petroleum that must be accepted for shipment in bulk, the M. C. B. Association has found it necessary to promulgate specifications for the construction of tank cars for the transportation of different kinds of oils, naphthas, benzine, etc., to cover not only the material to be used in the tank plates, but also the method of construction, whether riveting or welding, and the size and location of the safety valves on the same. These specifications are also in accordance with the requirements of the Inter-State Commerce Commission on the same subject. Safety valves on tank cars must be set so as to blow off at a specified pressure, in proportion to the vapor tension of the liquids contained; and must operate and relieve the pressure when the vapor pressure increases by reason of the heat developed by any fire to which the car may be exposed, either by reason of wreck or a conflagration near the track.

A committee reported to the convention that the railroads have great difficulty in securing satisfactory rubber hose for air brake and signal connections. They find that some hose stretches too much, becomes soft, porous and leaky; and, on the other hand, some hose becomes brittle, and cracks, also causing air leakage. It is a matter of common knowledge among engineers and trainmen that locomotive air pumps in freight service are overworked; and this is largely because in a long train there are usually many leaky hose lengths to which air must be supplied in order to maintain normal pressure in the train pipe. The committee has drawn up specifications covering the quality of rubber and canvas to be used in the manufacture of standard air-brake hose.

Another question to which the convention gave considerable attention and discussion was the report on the electric lighting of trains. As is well known, there are three principal systems in use: (a) the "head end" system, employing an engine-driven generator in the baggage car; steam for the engine being supplied from the locomotive; (b) storage batteries carried in boxes under each car; and (c) the axle lighting system, having a generator mounted on one of the trucks of each car and driven by a belt passing over a pulley on the axle. This system also employs a storage battery as an auxiliary, to supply electricity when the train is not running as well as at speeds less than seventeen miles per hour. Two standard voltages, 30 and 60 volts, are in use; the tungsten lamp is now in common use for this kind of lighting, in fact, is used almost exclusively, and a great deal of study and experimentation has been turned upon finding the best kind and shape of shade to furnish pleasant illumination, bright enough for reading, without objectionable glare. Car wiring is put in regular conduit, and all circuits are brought to a switch panel in the car and provided with approved types of fuses. Few people realize the advance that has been made in the art of train lighting during the past two years; and in this connection the Association of Railway Electrical Engineers has done a great deal of work in developing the details of successful electric lighting for trains; not only in designing new apparatus, but in perfecting mechanical appliances for axle mountings, battery boxes, etc.

Other topics presented and discussed were those on car coupler side clearance and standard dimensions, best location of train pipe for steam heat connection, freight car springs and cast steel truck frames. The committee on brake shoe tests also reported progress in the investigation of rate of retardation of revolving car wheels by brake shoes at different pressures. It was stated, however, that the results on the brake shoe testing machine are not strictly comparable with service conditions, where the wheel is rolling along a rail, and, that consequently the conclusions must be accepted with caution.

The subject of car shop apprentices was brought up, and the consensus of opinion seemed to be that boys who enter a shop as apprentices do not have sufficient encouragement held out to them to induce them to continue in the car department of a railway after they have become first-class workmen. In consideration of the knowledge and skill acquired during apprenticeship, many young men seek employment where they can obtain better pay; usually with the railway equipment manufacturers; so that the railway companies have a rather limited number of trained, skilled men upon whom to depend for making promotions.

The sessions of the M. C. B. Association closed on June 14th, and were followed a few days later, June 18th, by those of the Master Mechanics' Convention, held also at Atlantic City.

Experiments with Blue Glass

(*Concluded from page 11.*)

Through two or more thicknesses of blue glass look at a lighted candle placed at a distance of more than six feet from your eye. While so doing hold your forefinger vertically in contact with one corner of your eye and bring it slowly toward the center of the eye until it intercepts a part and only a part of the beam of light which passes through your pupil (see the accompanying figure), that is, until the light of the candle suddenly becomes dimmer. Instead of one flame you will then perceive two. They stand side by side: one is blue, but the other is as red as blood, without any admixture of blue. Thanks to the anachromatism of the human eye, the crystalline lens acts in that case as a prism and the suppression, through the cobalt glass, of almost every intermediate color between the two extremes of the spectrum allows the clear separation of the red from the blue. As to the forefinger its object is to close the central part of the pupil and to allow the passing of light only through the most anachromatic part of the crystalline lens, i. e., its margin.

Chancing one day to look through two glasses, one blue and one yellow, placed one behind the other, the physicist Sinler was amazed to find out that while other objects were but little changed, foliage and grass had become of an intensely red color. A glance at the spectrum of the light reflected by chlorophyl explains the mystery. This spectrum contains an extraordinary amount of the extreme red for which the cobalt glass is transparent. Most other colors are stopped either by the blue or by the yellow glass. The experiment is well worth being made, as the appearance of a landscape with everything about as usual except that every leaf or bit of grass is as red as blood is extremely fantastic. Unless the blue glass is very thick and dark two pieces, one behind the other, must be used. One yellow glass is enough. It is essential that the vegetation be in full sunlight. Diffused light on a cloudy day gives no results at all.

Although the writer has come across more than one mention of the curious experiment he is about to describe, he has been unable to find the name of its author. Besides the blue glass a concentrated solution of quinine sulphate, to which a few drops of sulphuric acid have been added, is needed. With this liquid used as ink and a pen cut out of any piece of wood (a steel pen should not be used), the experimenter writes on a sheet of white paper. When dry, the script cannot be read, as quinine sulphate is as white as the paper. But if it is placed in a dark room, in such a position as to be lighted only, or almost only, by a beam of sunlight which has passed through a blue cobalt glass, the handwriting, while so lighted, is plainly visible in white on a blue field. No other sympathetic ink equals quinine sulphate in the rapidity with which the script can be made to appear or to disappear.

The writer has failed to obtain similar results with a blue screen made of a concentrated solution of copper sulphate, which absorbs the red and most of the

violet and ultra-violet rays. Methylene blue, which allows the passing of these rays, gave positive results. It is probable that the explanation of the phenomenon lies in the absorption by the cobalt glass of such rays as do not cause the fluorescence of quinine sulphate. The paper is thus considerably darkened, but the fluorescent script remains about as luminous as if in white light.

Superheated Steam in Locomotive Service

AN Abstract of Publication No. 127 of the Carnegie Institution of Washington, by W. F. M. Goss, has just been issued as Bulletin No. 57 of the Engineering Experiment Station of the University of Illinois.

This bulletin gives a summary of foreign practice in the use of superheated steam; it contains a report of an elaborate series of tests made upon an American locomotive to determine the precise advantage to be derived from superheating under various conditions of locomotive service; and it shows that the use of superheated steam is not attended by serious difficulties. The superheater is easily maintained, and its presence as a detail of locomotive mechanism introduces no new problems in maintenance. The superheater improves the efficiency of the locomotive through the saving of coal and water. Tests run with boiler pressures varying from 120 to 240 pounds per square inch, for which the steam was superheated approximately 150 deg. Fahr., prove that neither the steam nor the coal consumption is materially affected by considerable changes in boiler pressure. This fact justifies the use of comparatively low pressures in connection with superheating. The saving in water consumption was found to vary from 18 per cent at a boiler pressure of 120 pounds to 9 per cent at a boiler pressure of 240 pounds, the corresponding saving in coal varying from 17 per cent to 6 per cent between pressures of 120 pounds and 240 pounds. The power capacity of the superheating locomotive was found to be greater than that of a saturated steam locomotive of the same general dimensions.

Copies of Bulletin No. 57 may be obtained upon application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

The Current Supplement

THE current issue, No. 1905, of our SUPPLEMENT brings a number of interesting and important articles. Mr. Cooley reports on some tests of vacuum cleaners.—Mr. Miller gives a concrete example of the applications of Motion Study to the improvement of manufacturing efficiency.—Mr. John Jay Ide, who is well known to our readers, describes the Tatin-Paulhan Aero Torpedo.—Prof. E. F. Northrup gives a most interesting survey of the range of temperatures known to us in the laboratory and in nature, and of the properties of matter as it is exposed to different portions of this large range.—There is no nation in the world's history which has shown such rapid rise from comparative obscurity to modern civilization as the Japanese. Something of what the Japanese have done in science is told us in an article entitled "Some Japanese Scientists."—The utilization of water-power through the medium of electricity, for industrial purposes, is a subject that can never lose its interest. An article on this subject, illustrated by a front page and other engravings, forms part of the present issue.—Mr. Hartley M. Phelps tells us of American industrial enterprise in India.—Mr. Tweedy writes on the Cold Storage of Furs and Fabrics.—Prof. Houssay, of Paris, discusses the body shape of fishes as influenced by the effect of water pressure.—Those of our readers who own microscopes will be much interested in an article on the fine adjustment of these instruments.—The subject of baldness and grayness, treated of in a special article, is one which is apt, sooner or later, to engage the attention of all of us.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII.] NUMBER 2.] NEW YORK, JULY 13, 1912 [PRICE 15 CENTS $3.00 A YEAR

Prof. Elie Metchnikoff

The Most Distinguished of Living Bacteriologists and His Work

By Sir Ray Lankester, K.C.B. and F.R.S.

[THE following article is abstracted from an essay entitled "Metchnikoff and Tolstoy" by Sir Ray Lankester, forming one of a series of popular scientific discourses collected in book form under the title "Science From an Easy Chair" (Methuen and Co.). The author enjoys a personal acquaintance with Prof. Metchnikoff and, is therefore, able to give first hand information on a study of prolonging human life, which has recently attracted wide-spread attention.—EDITOR.]

The recognition of the derivation of man from animal ancestors, and of the complete community of the structure and the chemical activity of the organs of man with those of the organs of animals, has made the study of the diseases of animals a necessary feature in the understanding of the diseases of man. The far-reaching principle of Darwin that the mechanisms and processes observed in the bodies of plants and of animals (including man) must have been selected in the struggle for existence and perpetuated, because of their utility, led Metchnikoff to inquire what is the value or use of the process called inflammation and of the "eating corpuscles" or "phagocytes" (so called by him) which wander from the blood into inflamed tissues. This question had led him to the discovery that the phagocytes engulf and destroy disease-germs, and are the great protectors of the animal and human body against bacteria and others germs which enter cut and wounded surfaces, and would start disease were there not "inflammation," which is nothing more nor less than a nerve-regulated stagnation of the circulation of the blood at the wounded spot, and the consequent arrival at this spot of thousands of "phagocytes," which pass out of the stagnant blood through the walls of the fine blood-vessels. These armies of phagocytes proceed to eat up and destroy all the germs which fall on to the wound—from the air, from dirty surfaces, and from the skin. The utility of inflammation and its gradual development, according to Darwinian principles, in the animal series, was shown over twenty years ago by Metchnikoff. His important work on "immunity" and on infection and on protection against germ-caused disease is thus seen to be one of the many flourishing and valuable branches of knowledge which have originated from Darwin's great conception and his example in experiment and inquiry.

Metchnikoff is now devoting all his attention to the possibility of prolonging human life. The facts seem to show that if we ate and drank only what is best for us, and led lives regulated by reason and knowledge, we should, nearly all, attain to eighty or even one hundred years of age, having healthy minds and healthy bodies. We should die quietly and comfortably at the end, with much the same feeling of contentment in well-earned repose as that which we now experience in going to sleep at the end of a long and happy day of healthy exercise and activity. Metchnikoff thinks that the cause of too early death may be ascertained, and when ascertained avoided or removed. In 1870, in a little book on "Comparative Longevity," I distinguished what we may call the "possible life" or "potential longevity," of any given human being from his or her "expectation" of life. Potential longevity has been well called our "lease" of life. It is probably not very different in different races of men or individuals, and is probably higher than King David thought, being one hundred to one hundred and twenty years, and not merely seventy years. We all, or nearly all, fail to last out our "lease" owing to accidents, violence, and avoidable, as well as unavoidable, disease; so that seventy years is named as our tenure when the injury done to us by unhealthy modes of life and by actual disease are considered as inevitable. Metchnikoff proposes to discover and to avoid those conditions which "wear down" most of us and produce "senility" and "death" before we have really run out our lease of life.

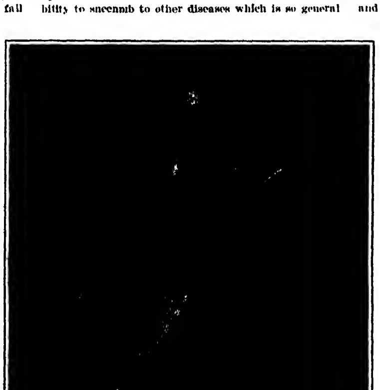
Human beings die most abundantly in the earliest years of life. Statistics show that at birth the chance or expectation of life is only forty-five years, while at ten years old you may expect to live to be sixty-one. At thirty you have not a much better chance—you will probably, if you are what is called a "healthy" life, die when you are sixty-five. But if you survive to be fifty, you may expect, if you have not any obvious disease or signs of "break up," another twenty years, and will probably die at seventy; surviving to sixty, you may expect, if you are what passes for "healthy," to live to seventy-three. Now, it is especially with regard to life after forty or fifty years of age that Metchnikoff is interested. Those who have survived the special dangers and difficulties of youth, and have arrived at this mature age, ought to be able to realize much more frequently than they do something like the full "lease of life." There seems to be no reason why they should not avoid the usual rapid "senile changes" or weakness of old age, and survive, as a few actually do, to something like one hundred. The causes of "senile change" and the way to defeat their operation are what Metchnikoff is studying. Hardening of the walls of the arteries set up by certain avoidable disease contracted in earlier life, and by the use of alcohol (not only to the degree which we call "drunkenness," but to such a degree as to make one depend on it as a "pick-me-up") is an undoubted cause of that weakness and liability to succumb to other diseases which is so general after fifty years of age. The causes which produce hardened arteries can be avoided.

Another cause of senile changes is declared by Metchnikoff to arise from the continual absorption of poisonous substances produced by the decomposition of partially digested food in the lower bowel or large intestine. This is at present the chief subject of his study. It is to prevent the formation of these poisons that he has introduced the use of sour milk, prepared with the lactic ferment.

Metchnikoff has made some very interesting experiments in progress with animals. He used the large tropical fruit-eating bats, or "flying foxes" and also monkeys. Bats have a very short intestine, and very few bacteria and of very few kinds are to be found in its contents. On the other hand, there are as many as thirty distinct kinds of bacteria producing putrefaction or other chemical change in the digestive canal of man—and their quantity is gigantic. They pervade the whole contents of the human digestive canal by millions. By properly feeding the flying foxes in his laboratory in Paris, Metchnikoff actually succeeded in getting rid of all bacteria from their digestive canal, so that he obtained adult mammalian animals, not very remote from man in their structure, food and internal chemistry, which are absolutely free from the intestinal parasitic bacteria which he supposes to cause poisoning and senile changes in man. It is obvious, without pursuing the matter into further detail here, that Metchnikoff is in a position to test his views as to the action of particular kinds of bacteria—he has animals which are free from them. He can make an experiment, keeping some of his bats still free from bacteria and causing some to be largely infected by this or that kind, and he can compare the result in regard to the health and chemical condition of the animals. So, too, the patients from whom the lower intestine has been removed, may very probably furnish him (through his assistant who remains in London) with important facts for comparison with the condition of persons who have not been deprived of this part of the digestive apparatus.

I have given this sketch of what my friend is doing, in order to furnish some notion of the kind of investigation which he pursues. He does not expect to extend the "lease" of human life, but by ascertaining in a definite scientific way the true rules of internal and external "hygiene" he does hope to give mankind an increased "expectation" of life, in fact, to enable a vastly larger number of men and women to enjoy that lease to the full, and to die without disappointment and regret, even with contentment and pleasure, at the end of it.

Metchnikoff was in Russia in the spring of 1909, and spent a day with Tolstoi. They were "feted" and photographed together, the greatest artist and the greatest scientist of Russia. Tolstoi is 81 years of age. He took Metchnikoff out alone for a drive in his pony-cart so as to talk with him without interruption. "What do you think of life?" was the first question he asked, and one which it took my friend some time to answer. In regard to vegetarianism the two great men did not agree. When Metchnikoff declared that there was less cruelty on man's part in killing wild animals to eat them than in leaving them to die by the tooth and claw of predaceous animals or from starvation, Tolstoi observed that that was argument and reason, and that he paid no attention to them; he only guided himself (he said) by sentiment, which he felt sure told him what was good and right!



Photograph by Hoppe.

ELIE METCHNIKOFF

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 13, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer,
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions, Mexico, Cuba and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid,	3.75

The Scientific American Publications

Scientific American (established 1845)	per year	$3.00
Scientific American Supplement (established 1876)		5.00
American Homes and Gardens		3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check.

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

No Contest for the Gould-Scientific American Prize

FOR the second time Mr. Edwin Gould's generous offer of $15,000 for a safe, multi-motor, flying machine has failed to meet with any effective response. The Contest Committee was present at the field of the Hempstead Plains Aviation Company, which had been kindly placed at their disposal for July 4th, and as none of the entrants had a machine on the grounds, the Committee had to go through the formality of declaring that there was no contest. Mr. Gould does not feel justified in making a further extension of time, and the prize is now definitely withdrawn.

Of the eleven entrants, only three or four seem to have made any serious effort to build a machine that would comply with the conditions. One of these, a biplane, built by the Burgess-Curtis Company for Howard Gill, was completed, tested in flight and ready to ship, and we greatly regret that the meritorious attempt of this young and promising aviator should have been frustrated by the failure of any other entrant to have his machine ready for the contest.

So far as the other entrants are concerned, the SCIENTIFIC AMERICAN is of the opinion that the failure of the few that made an effort to build machines was due, not to lack of interest in the competition, but rather to the want of adequate means and facilities. But what is to be said of the indifference of the various aeroplane construction companies outside of the Burgess-Curtis, who, having both the aeroplanes and the motors, and experienced pilots, might have placed machines on the field at a moderate cost and with little inconvenience?

We are driven to the conclusion that they are more concerned with gate receipts at flying meets than they are with the development of the art itself for its own sake—a deplorable condition to exist in that very country which gave birth to the first practicable aeroplane.

It cannot be objected that the conditions imposed for this contest were too onerous. Certainly they were not impossible, for while our aeroplane builders are holding back, Germany has shown us the way in most brilliant fashion. The flight of Hirth with a passenger from Vienna to Berlin in a two-motor, two-propeller monoplane, at a reputed average speed of sixty miles an hour, was a feat far more difficult, surely, than that demanded under the conditions of the Gould-SCIENTIFIC AMERICAN Prize.

Nor can it be urged that the object which prompted Mr. Gould's offer was wanting in appeal. If we were asked to name the quality in an aeroplane which, just now, is most urgent in its demand for consideration, we should unhesitatingly name that of safety. The alarming number of aviators of experience who have fallen to sudden death during the past few weeks should be taken as a loud call for any device of a practicable nature that will render aviation reasonably safe—and among these, the provision of separate motors and propellers, with one plant normally in reserve, must always hold a high place. The prize which is now withdrawn was notable as the first and only offer made for an improvement whose object was to protect the life of the aviator, and render the new art reasonably safe.

Mr. Gould's generosity, to say nothing of the several inducements offered by certain leading papers, has silenced the complaint of the aviators that they do not receive, in this country, the financial assistance which has carried aviation in Europe to its present commanding position.

The Death of Melvin Vaniman

WE have spoken somewhat glibly of the "Conquest of the Air," until the phrase has become trite, and savors of platitude. Yet almost daily we are reminded only too forcibly that the air is not yet conquered, that the battle with the element is still being waged, and is claiming its full toll of human life. We follow with interest and pride the records that are newly established almost every week in the field of aeronautics. A mournful record belongs to last week. On Tuesday, July 2nd, Melvin Vaniman, with his crew of four men, met their death as the result of an explosion aboard the "Akron," the airship on which Vaniman hoped to cross the Atlantic; on the previous day Miss Quimby and Mr. Willard were dashed to death from a monoplane.

When we read the roll of victims that the air has claimed, or the account of the heroic manner in which the men aboard the "Titanic" met their death, for a moment some of us may feel our scientific creed shaken. What of the principle of the survival of the fittest? Is it not the brave and daring, the heroes, that are being swept away, while their less enterprising or more timid fellows are preserved in the safety of common everyday life? Are the brave, therefore, to be classed among the "unfit," to be weeded out in the progress of time? The answer is not far to seek. Some individuals must be sacrificed that the community may benefit. Just how this benefit arises we may not always be able to see in any one specific instance. But can we doubt that the nation which harbors such characters as Vaniman, or whose men stand up under the test of death as did the passengers of the "Titanic," will carry off the victory in the battle of nations, whether in actual warfare or in the industrial contest of peace? Such a nation is "fit," because it numbers in its population men who risk their life in the cause of the advancement of arts and knowledge, or who sacrifice it unflinchingly for the sake of high principles.

Vaniman, like many an inventor before him, died a victim to his own theories; and his sudden taking off is rendered the more pitiful by the fact that his theory was correct, and had he only waited for the completion of his new "wire-cloth" machine, he might have escaped disaster.

In seeking to construct a dirigible of constant displacement, with a shell of sufficient strength to withstand the increase of pressure due to rise of temperature, he was treading the one road—at least so we judge—along which development of the dirigible must proceed, if it is to become a really practical machine.

Let no one make the mistake of placing this man among the mere dreamers. He was practical, clear-sighted, and logical. His conception of a constant-displacement machine was based upon sound theory and practical experience, gained in his earlier work. His comparison, in conversation with the writer, of the spherical drifting balloon, with its steady loss of gas, to a ship that is launched with the certainty that it is leaking so badly that it will soon go to the bottom, was quite to the point. "A ship is water-tight and rigid, and my airship must be reasonably rigid and gastight," he said.

Vaniman has left behind him in his wire-cloth fabric a material which may yet prove to be the solution of a hitherto unsolved problem. The failure of his weaker rubber-cloth fabric to stand the tangential stress proves only that in this particular case it was unequal to its duty. The wire-cloth is over 30 times stronger, and it is to be hoped that the line of investigation which has been opened by Vaniman will be followed up by the interests which were behind his meritorious if tragic attempt.

Doctors of Civilization

READ the terse yet masterful account that Thucydides gives of the "Black Death," a scourge which, despite their remarkable civilization, the ancient peoples clustered in Southeastern Europe and Asia Minor were unable to combat, or peruse Pepys' description of the terrible ravages of the Great Plague in London, and the thought strikes home that the gregarious instinct of man cannot be satisfied without paying a tragic toll. The diseases of perilous occupations, the accidents due to unprotected machinery, the ills obviously caused by poor ventilation, all these can be avoided by the ingenuity of the architect and the engineer. But the pests that have decimated even a rural population are not prevented in any obvious way. Their origin is hidden in wells that apparently yield only pure water, in the bites of insects apparently harmless. They are, in truth, diseases of civilization, which require for their eradication scientific investigation as painstaking and self-sacrificing as the researches that have given us the wonderful antitoxins and sera by which we cure typhoid fever, diphtheria, pneumonia and other maladies, [illegible].

Not until the bacteriologist with his microscope and his stains had discovered the germs, invisible to the naked eye, that are responsible for most of the ills which flesh is heir to, did it become possible to create the modern profession of sanitary engineering—to educate, in a word, the doctor of civilization. Prevention is the watchword of that new profession—prevention of the conditions under which deadly bacteria may thrive and prevention of the transmission of these bacteria should they breed. Not without the sacrifice of men who could ill be spared has this truth been learned. Heroes have been found, willing to subject themselves to the stings of bacteria-carrying insects, in order to prove that not the exhalations of swamps but the natural inoculating needle of the mosquito is the real cause of some infectious diseases; that *miasmas* do not in themselves cause ills, but simply aid the breeding of the living vehicles that carry disease germs.

Within the lifetime of living men it was thought that only a physician was fitted to be head of a Board of Health. Even in the smaller towns a medical man is still found intrusted with the well-being of hundreds and perhaps thousands of town dwellers. Gradually, the new doctor of civilization, the sanitary engineer, the public health expert trained to cope not with the ills of individual human beings but with epidemics that devastate whole communities, is coming to the front. Such is the need for these men that our technical institutions are now offering courses in sanitary engineering. To the Massachusetts Institute of Technology belongs the credit of having, years ago, established the first of these under the guidance of Prof. W. T. Sedgwick. Other institutions soon followed. They have all justified their existence by graduating many students, now actively and successfully engaged in public health work. Not many years will pass when the health of every community will be intrusted not to a graduate physician but to a trained public health expert.

Lunacy and Morals

CHIEF SURGEON PICQUE, of the Seine Lunatic Asylum, is reported to have addressed the Academy of Medicine in Paris on the operative treatment of forms of insanity arising out of appreciable lesions, such as abscesses and tumors of the brain and nervous system; or out of such affections of other organs, remediable by operation, as may affect cerebration through extension of their toxic products in the lymph and blood channels. Unquestionably such surgery may prove effective; the like work of other surgeons has proved so. In some idiots, moreover, mental regeneration seemingly miraculous has come after thyroid transplantation, or after the medical administration of the thyroid extract of the sheep.

Here there is no occasion for skepticism. One does not, however, altogether follow those who claim surgery to be efficient in the cure of human immorality. A brain tumor is a tangible, material thing; but an immorality (or is it an un-morality?) is an entity so metaphysical, so conditioned upon the will, that it were difficult to see how surgery can be effective in the premises. And yet it is worthy of reflection that in any prison one sees microcephalics, scaphocephalics and other unfortunates so born with anatomical stigmata that their moral sense is blunted or perverted. Such are unable to feel responsible for whatever unlawful acts they have committed; the insane asylum, not the prison, should be their place of confinement.

The difficulty is that one cannot always see clearly the line separating responsible wickedness from acts against the public peace which have their origin in perversities of the psychic apparatus. The difficulty would be largely cleared up if definitions of mind and morality acceptable to everybody could be formulated. To the scientist morality is the crystallization of natural law, a definition that might help to some very fair conclusions.

Many humanitarians now hold extreme views as to irresponsibility for criminal acts—views which, if generally accepted, would surely imperil the social structure. It has indeed become very difficult, to such extreme has the pendulum now swung, to convict those who have committed the most heinous crimes. Besides, there is a tendency to make prisons so comfortable that one is puzzled why those against whom indictments have finally been secured, do not immediately enter these luxurious institutions, instead of wasting so much of the time of jurymen, and so much of the public funds, in proceedings which so rarely end in conviction. There is, moreover, constant agitation for the substitution of trepanning for hanging, of optometry for trial by jury; such depravity as may not be eradicated by the dentist, or by the nose and throat specialist, or by the adjustment of proper spectacles, may nevertheless, by the exercise of a little considerate patience, yield to deep breathing, or the rest cure, or the hot air apparatus, and the like.

Engineering

Gas Engines in High Altitudes.—A gas engine, says *Science Conspectus*, was erected several thousand feet above sea level. The engine did not give the power expected, and it was concluded that the loss was due to the altitude of the station. Upon investigation of the theoretical and practical considerations involved, it was found that there is a loss of about 1 per cent of the indicated horse-power for each 1,000 feet of increase in elevation. The effect with a low ratio of compression is slightly less than with a high degree of compression.

The Power of an Air Brake.—Some idea of the power of an air brake may be gained from the following facts: It takes a powerful locomotive drawing a train of ten passenger cars a distance of about five miles to reach a speed of sixty miles per hour on a straight and level track. The brakes will stop the same train from a speed of sixty miles per hour in 700 feet. Roughly, it may be stated, says *Science Conspectus*, that a train may be stopped by the brakes in about 3 per cent of the distance that must be covered to give it its speed.

Anti-"Baggage-Smasher" Mats.—We have received from the Pennsylvania Railroad Company drawings of an interesting and, we are told, very successful cushion for unloading baggage from trucks in baggage rooms. The mats, which are 22¼ inches wide by 4 feet 4 inches long, are made of four strips of hard wood, 4 inches wide by 4 feet 4 inches long, across which are nailed 24 pieces of scrap air-brake hose. We are informed that the mat does its work admirably, of which fact no doubt the prospective railroad traveler will take due notice and comfort.

Utilizing Panama Canal Plant.—We have received from Mr. Frank Vanmeter, of Canton, Ill., a suggestion that a part of the dredging and excavating plant at the Panama canal might be shipped, when the canal is completed, to the Mississippi Valley, and there used by the Government in re-building and enlarging the present levee system. It is suggested that the excess material dredged from the river might be utilized in filling up a part of the adjacent low-lying lands, and that this would at once serve the double purpose of increasing the flood capacity of the river and recovering land which is now subject to flooding.

Electrifying a Canadian Steam Railroad.—An important work of electrification is being done on a section of the Rossland Division of the Canadian Pacific Railway, in British Columbia, extending from Rossland to Castlegar Junction. The Rossland Division is 29.3 miles in length, and if the sidings and tracks in the yard are included, the total length of track to be electrified is 43 miles. Current at 60,000 volts will be received from the West Kootenay Power and Light Company, and the hauling will be done by four 75-ton electric locomotives. It is yet to be determined whether alternating current at 6,600 volts, or direct current at 2,400 volts, will be employed.

The World's Largest Building.—The first day of July the topmost piece of steel work was riveted in place on the Woolworth Building in New York. This structure is notable as being the loftiest building devoted to business purposes in the world. From the sidewalk to the top of the cupola is 750 feet, which is 50 feet more than the height of the Metropolitan Building in this city, and 138 feet more than the height of the Singer Building tower, also in New York. The building contains fifty-five stories in the tower. It is of the standard steel column and floor beam construction; but in order to take care of the enormous dead load and the great wind load, the columns are necessarily of unprecedented size.

The Inner Structure of Metal.—J. Alfred Ewing, in delivering the May lecture of the Institute of Metals, drew attention to the fact that when it was desired to examine a metal microscopically, the first step taken was to polish the section. As Dr. Beilby had shown in the previous May lecture, this polishing seriously affected the constitution of the surface, making it quite different from that of the metal below. It produced an amorphous layer, distinct in constitution from the crystalline structure, which became apparent when this layer was removed. This removal was commonly effected by a light chemical attack, the metal being etched by a weak acid. It could also be done by heating the specimen and subliming away or evaporating off the amorphous phase.

Cape Cod Canal Progress.—When the delegates of the recent International Navigation Congress visited Cape Cod, they were assured that this work would be opened to traffic during the winter of 1913, or at the latest in the spring of 1914. The canal will provide a 25-foot depth from Barnstable Bay to the 30-foot depth in Buzzards Bay, a distance of 12½ miles. The minimum width on the bottom will be 200 feet. The canal will enable ships to avoid the dangers of the stormy outside passage around Cape Cod, and it will shorten the distance from Boston for ships passing through Long Island Sound by 66 miles. Fifty thousand vessels of a total tonnage of 25,000,000 and carrying 500,000 passengers pass around Cape Cod every year, and the majority of this traffic, it is expected, will seek the shorter and more sheltered route.

Electricity

Condensers on Lighting Circuits.—*The use of condensers* to obtain better economy and power factor on the circuits of low-voltage lamps has been rendered possible by improvements in the manufacture of tinfoil and paraffined paper condensers. By immersing the condenser roll in melted paraffine after vacuum impregnation, and subjecting the paraffine to high mechanical pressure during cooling, thorough durability, and efficiencies up to 99 per cent at full load, are readily obtained.

Street Cleaning by Electricity.—In several German cities street washing machines driven and operated by storage batteries are in operation. The machine employed is a 3½-ton vehicle equipped with a 40-cell battery giving 200 ampere-hours at the 5-hour discharge rate, with traveling speeds of 4, 6 and 9 miles per hour. It carries a heavy tank of water, brushes, and rotating rubber scrapers. There are 24 of these machines at work in Berlin at present, with six special charging stations, and each machine covers 18 to 25 miles per day and costs less to operate than a horse-drawn machine.

A New Light-weight Storage Battery.—The present capacity of lead-plate storage batteries capable of withstanding the shocks of ordinary mechanical usage to which they are subjected in automobiles, electric cars, and railroad trains is stated to be 30 to 35 watt-hours per kilogramme of battery. The principal of the Royal Technical College, Copenhagen, has announced the invention of a lead-alloy storage battery the plates of which are extremely porous so as to increase the active surface in contact with the electrolyte. At a discharge current density of about 0.005 amperes per square centimeter, which is the normal for ordinary train-lighting cells, and an ampere-hour efficiency of 91 per cent, the capacity of the plate of the new battery is stated to be 4½ times that of the ordinary battery plate.

Crystallization of Metal Lamp Filaments.—It is well known that the metal filaments of modern incandescent lamps become more fragile after use. A recent investigation of the changes set up in metallic filaments by use, including a microphotographic study of both "drawn-wire" and "extruded" filaments, has proved that the continued high temperature at which the filaments are run causes the metal to crystallize. The coarse crystals which ultimately mean breakage of the filament are built up by accretion upon the fine crystals in the original structure of the metal. Drawn-wire filaments, having a finer initial crystallization, are stronger at first, but show no advantage over the extruded filaments after both have become crystallized.

Electric Lighting for the British House of Commons.—The electric lighting which it is proposed to substitute for gas in the debating chamber of the House of Commons is to consist of groups of three metal filament lamps inclosed in a holophane globe and placed over a square pane of amber tinted glass. This provides three thicknesses of glass, which are depended upon to cut off ultra-violet rays. Uniformity of illumination is to be secured by the dispersing effect of the globes. The amount of illumination on the benches, now obtained by gas lighting, is four-fifths of a candle-foot, and the same amount or more can be obtained by the electric light—one candle-foot being usually considered requisite for reading purposes.

Detecting the Proximity of Icebergs.—A Canadian physicist has devised a microthermometer for detecting the proximity of ice at sea by observing the temperature effects in the water currents around the mass of melting ice. The instrument for this purpose is inclosed in an iron cylinder, arranged to be submerged about five feet below the surface of the water and is connected by cable to an electrical registering and recording device on deck. This sensitive apparatus registers temperature variations otherwise entirely overlooked, and indicates the presence of an iceberg at a distance of half a mile. The character of the temperature changes and the rate at which the changes take place are found to be more significant for determining the presence of ice than the temperatures themselves.

Advantages of Electric Locomotives.—A recent paper on electric locomotives for the handling of freight in railroad yards and in mining brought out clearly certain advantages over steam locomotives apart from the elimination of fire and smoke and the difference in fuel efficiency of the central station boiler and engine and the (smaller) locomotive boiler and engine. The electric locomotive can be relied upon, as long as the line voltage is maintained, to develop its full power at any time, being independent of the state of a boiler, the skill of a fireman, or the quality of fuel. The track adhesion is better—sometimes as much as 20 per cent better—because the torque of the driving wheels is uniform throughout each revolution, and there is not the same tendency to slip when starting under load as in the steam locomotive. The traction can be increased indefinitely by sanding the rails, since the electric locomotive can draw power indefinitely from the line. No time is lost on the road for coaling, watering, boiler tending, or waiting for steam pressure to rise.

Science

Dr. de Quervain's Trans-Greenland Expedition is now under way, the party having sailed from Copenhagen for the west coast of Greenland the end of April.

Tenth International Geographic *Congress.*—*This* much-postponed meeting is, *according to the latest* announcement, to be *held in Rome in the week beginning March 27th, 1913.*

A Dry Month in England.—During April, 1912, the total rainfall registered at Greenwich observatory was only 0.02 inch. This is the driest month recorded at that observatory, at any period of the year, for 100 years.

Dr. S. Rona, late vice-director of the Meteorological and Magnetic Institute of Hungary (the national weather service of the country), has been appointed director of that institution.

Explorations in Iceland.—A remarkable series of explorations was carried out in Iceland during the years 1910 and 1911 by a Swiss traveler, Herm. Stoll, who covered a distance of over 5,000 kilometers (upward of 3,100 miles) in the course of the two years.

Finger Prints in Banks.—German banks, according to newspaper dispatches, have begun to introduce the finger print as a mark of identification on checks. The method is already in use in the United States.

Climatic Statistics of the British Isles.—A joint committee comprising two representatives of the Meteorological Office and two of the Royal Meteorological Society is planning the publication by these two organizations of a collection of climatic normals for the British Isles. Barometric pressure and wind direction will be first dealt with.

Designs for the Australian Capital.—According to press despatches the first prize in the competition for designs for the new seat of government of Australia, viz., £1,750 ($8,516), has been awarded to Walter Burley Griffin of Chicago, the second to Eliel Saarinen of Helsingfors, Finland, and the third to Alfred Agache of Paris. As decided three years ago, after long discussion, the new capital city is to be built in the Yass-Canberra district of New South Wales.

Another Attempt to Scale Mt. McKinley.—The Bulletin of the American Geographical Society reports that the expedition to Mt. McKinley which left Fairbanks, Alaska, on February 5th, fitted out by a newspaper of that town to attempt the ascent of the mountain, returned unsuccessful on April 10th. An elevation of 10,000 feet was reached on the north side of the mountain east of Peter Glacier, where precipitous ice cliffs prevented further progress.

The Harbor of Colombo.—In 1875 the late King Edward VII, then Prince of Wales, laid the first block of the southwest breakwater of the harbor of Colombo, Ceylon. Prior to that time the harbor had been an open roadstead, exposed to the full violence of the monsoons. On May 1st of the present year the Governor of Ceylon, Sir Henry McCallum, laid the final stone in an extension of the southwest breakwater, thus completing the construction of one of the finest artificial harbors in the world, which is a square mile in area and capable of accommodating 40 to 50 vessels of over 12,000 tons. The total cost of construction has amounted to about $15,000,000.

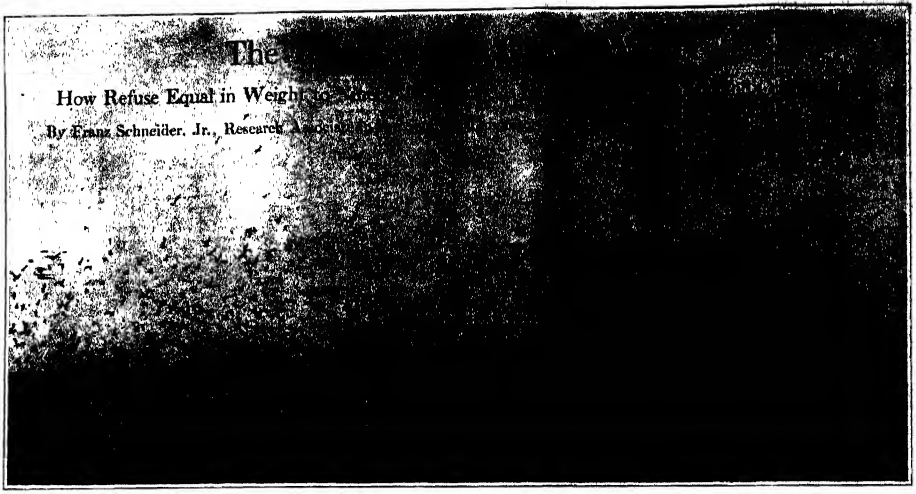
Banana Flour.—Banana flour specially prepared as a tonic food is making its appearance in Paris under the name of Bananéine. It is to be remarked that within a recent period this fruit was but little used in France, and even now its consumption is limited. However, measures are being taken to increase the importation, and it is said that 70 vessels were recently fitted up for bringing the fruit to Europe. Banana flour has a much more extended use in England than on the continent, but efforts are now made to introduce it in France owing to its great nutritious value. The bananéine is a preparation made for convenient use, and it contains 60 per cent of banana flour, this being put through a sterilizing process at the proper heat.

A Rubber Substitute from Sea Fish.—A press statement forwarded by Consul Frank W. Mahin of Amsterdam, tells of a factory established at Ymuiden at the mouth of the North Sea Canal in Holland to produce a substitute for rubber, and it is reported that the company operating the factory has succeeded in producing a substance having the qualities of rubber and some special advantages over the genuine. While the process is a secret the principal ingredient is said to be fresh sea fish, which are brought to Ymuiden in vast quantities by the Dutch fishing fleets. According to report 15 to 16 per cent of natural rubber is added to the fish, and the result is a substance as flexible and elastic as rubber, but much cheaper—about as 1.25 to 8 in price, compared with real rubber. The low price of this product will be caused partly by the by-products which are possible, for it is said that much albumen will be made from the fish and that half of the factory is arranged for the manufacture of fertilizer.

The

How Refuse Equal in Weigh

By Franz Schneider, Jr., Research A



Gulls in the wake of garbage scows.

AT the head of this article is a picture of the garbage disposal by dumping at sea, not a sanitary way, but at the same time in use by some of the large American cities. The number of gulls may serve as a measure of the enormous quantity of refuse, portions of which are almost certain to be stranded on neighboring beaches.

If the entire year's refuse of New York city could be gathered together, the resulting mass would equal in volume a cube about one eighth of a mile on an edge. This surprising volume is over three times that of the great pyramid of Ghizeh, and would accommodate one hundred and forty Washington monuments with ease. Looked at from another standpoint, the weight of this refuse would equal that of ninety such ships as the "Titanic" When it is remembered that this volume does not include sewage or other liquids, but only the dry, or relatively dry, parts of the city's wastes, it is evident that the problem of refuse disposal is one of the first magnitude, calling for great engineering skill and the expenditure of large sums of money

The material is burdensome not only on account of its great bulk, but because of its extremely heterogeneous nature In agricultural districts the matter is relatively simple: garbage is fed to the stock, old paper and other combustible material are quickly burned, and the unburnable rubbish goes to an unobjectionable dump heap. In the city, however, matters are much more complex. Ashes here become an important factor in the disposal problem, forming one half of the entire refuse by volume and two thirds by weight. Street sweepings, containing much horse manure and ordinary dirt in various guises, must also be cared for The diversified nature of the city's industries and occupations is, of course, what operates to make the refuse so extremely heterogeneous. Almost any conceivable object, ranging from orange peel to bicycles, and from mattresses to dead animals, may appear In attacking the problem, however, four general classes of refuse are recognized: garbage, ashes, rubbish, and street sweepings Special wastes—as from slaughter houses—will be encountered, but the main phases of the problem are indicated under the above headings Disposal may be said to have a two-fold object: to dispose of the material without nuisance or injury to health, and to attain this end at the minimum expense.

Methods of Collecting Garbage.

Any comprehensive plan for complete disposal must take cognizance of the methods of collection. If separate treatment is to be given to garbage and rubbish, it will be advantageous to have the householder put the two in separate receptacles, and separate systems of carting will also be indicated. If, on the other hand, the garbage and refuse are to be treated together, as they are in England, there will be no advantage in separation by the householder or in any separate systems of collection. The means of collection and disposal at present in vogue are almost as varied as the character of the material itself. There are different methods for each of our classes of refuse, and from these a very large number of plans for complete disposal may be devised. The determination of the best combination of methods for a given community is a matter of very considerable difficulty, and calls for special knowledge and engineering skill. It is sufficient here merely to note the inter-relations of disposal and collection schemes, and to pass on to a consideration of the principal methods in vogue in treating each of our four sub-divisions of refuse.

Let us consider first the disposal of garbage. In small communities the garbage is often sold or given to the farmers, an arrangement satisfactory in many cases from the standpoints of sanitation and cost. Again, it may be plowed into the ground, although this is now rarely practised. In larger communities collection and disposal to farmers is increasingly difficult, and this method becomes impracticable. Recourse is sometimes had in this case to mere dumping, either on land or water. The practice of dumping garbage on land is one that cannot be defended from aesthetic or sanitary standpoints. The dumps become ill-smelling eyesores, and are ideal places for breeding of flies. Dumping in water may be attended by serious nuisance arising from material drifting back onto the shores, and, like land dumping, is at best a profitless enterprise. When the community is of sufficient size, say someting like a hundred thousand population, these primitive methods may be discarded and more scientific ones—attaining more perfect disposal, and sometimes capable of actual profit—may be adopted. These are methods of reduction and incineration.

Reduction and Incineration.

In the so-called reduction treatment of garbage, the aim is to recover the grease from the material. Ordinary garbage contains, as a rule, 2 per cent, and sometimes as much as 3 per cent, by weight of grease. Reduction and the coincident recovery of grease are accomplished in two general ways. In the first, the garbage is cooked in large closed retorts by means of steam under pressure. After about a half hour's

Filling scows with refuse (not garbage) to be used in making new land.

Garbage, ashes, sweepings, when collected in the Borough of Richmond (New York) are thrown into a refuse destructor, where it is burnt into clinker. This clinker can be utilized in the same manner as broken stone in concrete construction.

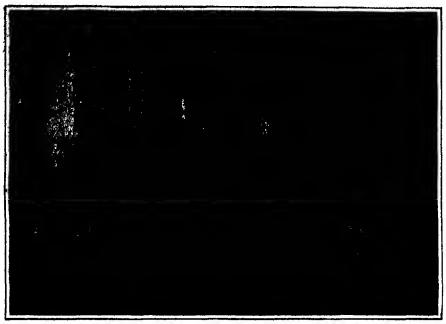
The tanks contain grease obtained from New York garbage.

digestion, the material is put through presses, removing the water and grease and leaving behind a comparatively dry cake, known as tankage, which has some value as fertilizer stock. The grease is skimmed from the water, purified roughly, and barreled for the market. In the other method of reduction the grease is extracted by some volatile solvent like naphtha. The garbage is sometimes dried as a preliminary to extraction. At all events, it is heated in contact with the solvent in closed vessels, after which the solvent is distilled off and the grease recovered. In both of these reduction processes the end products are the same, i. e., grease and fertilizer stock. Whether under ordinary conditions of operation the value of these products is sufficient to cover expenses is a debated question. In some instances, as at Columbus, O., the sale of the products has seemed to meet expenses. In a majority of cases, however, the process is carried on by private companies which must be subsidized by the city. This method of disposal is attractive from an economic standpoint, recovering, as it does, something valuable from an apparently valueless material. It is only fair to say, however, that reduction is usually attended by objectionable odors, making imperative the location of these plants at some distance from the city, and so adding to the expense of haulage. This may be regarded as distinctly American, being little practised abroad, where another method, that of incineration, is the favored one.

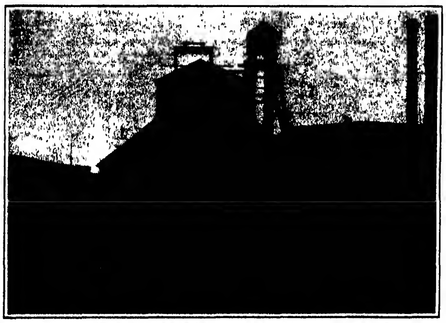
Garbage disposal by incineration must be considered with regard to our other classes of refuse. In this method the heat for incineration must be obtained not only from the garbage itself, but from ashes and other combustible waste. It is here that the distinction between incineration and the little-used cremation enters. In the former, the heat is obtained from the refuse itself; in the latter the garbage is burned at the expense of some regular fuel, such as coal or oil. Incineration is carried on in specially constructed furnaces. Garbage is mixed with the other refuse in the proper proportions and special devices are employed to feed the material into the furnaces so as to secure the best results. This method of disposal is entirely satisfactory from the sanitary standpoint, and gives, under proper operation, a slag or "clinker" which is valuable in construction work, while the resultant heat may be transformed into steam or electrical power. In the earlier attempts at incineration, using natural draft, the furnace temperatures were too low; objectionable smoke, noxious odors, and an undesirably soft clinker resulted. With the introduction of forced draft, these difficulties have disappeared, and in Europe, and in England especially, the disposal of the city's refuse by this method is complete, unobjectionable, sanitary, and sometimes profitable. Boilers are installed in the incinerators which will furnish relatively large amounts of valuable power. This may in turn be utilized for the generation of electricity, or for pumping when the incinerator is located in conjunction with water or sewage disposal works. On account of the unobjectionable nature of a properly designed and operated incinerator, it may be located in the center of the city, thus reducing the expense of haulage. As has already been indicated, there is a vast difference of opinion as to the comparative merits of reduction and incineration. Reduction has been a favored method in this country, but, owing to the large extent to which this process is in the hands of private interests, the facts as to the actual costs of the enterprises have not been fully available. In England, incineration has reached its highest development, and there appears to be an increasing use of this method in our own country.

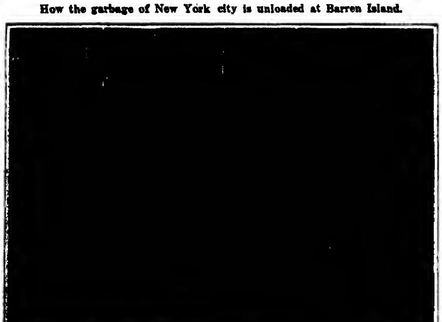
The Objectionable Method of Dumping.

The favorite way of disposing of ashes is by dumping, either on land or in the water. Ashes are often of real value as filling-in material for made land. Theoretically the land dump is merely unsightly and dusty; there is not the sanitary objection that may be urged against the garbage dump. But practically, from the fact that it is impossible to secure the proper separation of wastes by the tenant, the ash dumps in a crowded locality are largely garbage dumps with all their disadvantages. One must not forget, furthermore, that the ordinary run of ashes contains a very considerable amount of useful heating value which is lost when dumped.


Chute and digesters at the Barren Island garbage reduction plant.


Filling in Riker's Island with New York city waste (ashes, dirt, etc.).


How the garbage of New York city is unloaded at Barren Island.


The presses of the Barren Island garbage reduction plant.

The dumping of ashes and rubbish into water is open to much the same objections as the similar dumping of garbage. Unless the material is carried far enough from shore, and conditions of wind and tide are favorable, serious nuisance is certain to arise. The cost of carrying the material an adequate distance from shore then may become very considerable.

Rubbish, making up about a quarter of the total by volume and a sixth by weight, may be sorted over, paper and other combustible material removed and sold or burned for heat, while there is some salvage in junk. This picking over of rubbish is very dusty work, and there is a question as to its effect upon the health of the workmen.

Street sweepings with their manure may be plowed into the ground, or may be dumped, or may be disposed of in the incinerator. The last of these alternatives is perhaps the most desirable.

These are, briefly, the various methods by which municipal refuse is now being disposed of. The more primitive methods, as the selling of garbage to farmers, and dumping indiscriminately, are showing a tendency to disappear. They are being replaced, more especially in the larger cities, by the more scientific methods of reduction and incineration. The actual detailed plan which will be the most efficient for a given community can be determined only after an investigation of the nature of its refuse, and by the character of the community itself and its surroundings. The objects which must be carried in mind in making a selection of methods are to remove the wastes quickly and completely from sight without the creation of nuisance or danger to health, the recovering of whatever is valuable, and the carrying on of the whole operation at the minimum expense. The field of refuse disposal is one in which there is great variety of opinion and, perhaps, a lack of scientific practice. It is one, however, which by its magnitude and financial importance is worthy of the attention of our best engineering talent.

Stains on Brick

THE brown, white and yellow stains which frequently disfigure brick buildings or walls are the result of a saline efflorescence which may sometimes be removed, according to the *Bibliothèque Universelle*, by washing with slightly acidulated water, when pure water proves inadequate. Prevention, however, is better than cure. The stains are caused by particles of soluble salts which have been carried to the surface by water and are then crystallized by evaporation. These comprise sulphates of potassium, sodium, aluminium, magnesium, and calcium, the last being the one commonest found and the one most resistant to rain. Chlorides and carbonates are also often found. These salts pre-exist either in the earth or in the waters used in manufacture, or in the mortar or sand, the latter being especially the case near the seashore, where sand from the beach is commonly used without the precaution of washing with fresh water. The entry of salts into the brick may occur during the baking, also, when the coal contains pyrites. Care should be taken to use water of low mineral content, especially as regards sulphates. Where only "sulphur water" is available it should be neutralized with a barium salt (the chloride or carbonate).

Wireless Telegraphy in Peru

WIRELESS communication has been established between Lima and Iquitos, across a vast stretch of the Andes, without the use of intermediate stations.

The Business Side of German Science—VII

Making Money With the Aid of Technically Trained Men

By Waldemar Kaempffert

[THIS is the seventh of a series of articles, written by the Managing Editor of the Scientific American, *on German industrial conditions. The author was sent abroad by the publishers for the express purpose of gathering the material on which the articles are based. In this and the article to follow, the part played by the technically trained man in German business is pictured.*

The amazing industrial development of modern Germany is to be attributed in large part to technical education and to the application of science to business. Capital and science work hand in hand. Every one of the great chemical discoveries of our times, most of them made in Germany, are the result not of haphazard experimenting, but of systematic research that has meant the expenditure of princely sums. All German manufacturing is so thoroughly saturated with science, that even the small producer practises on a miniature scale the methods of his larger rivals.]

THE notion that industrial success is largely a matter of luck dies hard. The huge American trust is a refutation of the oft-repeated fable that chance plays the largest part in business success. In Germany the evidence that conspicuous industrial success is not nowadays attained without well-directed effort, without the aid of technically trained men, is even more apparent than in America. Every prominent manufacturing firm in Germany maintains its department for industrial research.

The Wonderful System and Organization of the Germans.

The scientific work of a great German manufacturing company naturally divides itself into three classes. In one class men are to be found whose duty it is to control the manufacturing operations from a special laboratory; in another will be found men who are engaged to do research work pure and simple, for the purpose of improving existing manufacturing processes, devising new ones, or discovering new products; and finally in the third class are men who try out a new discovery on a miniature factory scale in order to determine its commercial possibilities.

Perhaps the finest example, outside of the chemical industry, of the technical control of manufacturing operations is to be found at the cast steel works of Krupp at Essen. The uniformity of the Essen products is to be attributed entirely to the rigorous scientific control of the entire cast steel plant. Each step in the manufacture of steel is checked up in the laboratory. Analyses are made by the hundred. The work has been so systematized that boys and young men do the actual work under the supervision of a chemist. Thus it becomes possible to make five hundred analyses of iron for carbon dioxide in a day. The laboratory workers simply see to it that Bunsen burners are lit, that retorts are boiling, and that filters are working properly. The supervising chemists are thus permitted to perform more important duties than that of watching a burette or a test tube. The laboratory workers are simply tools in the hands of their supervisors. They must be intelligent enough to perform the tasks assigned to them, but they must not be so intelligent that they are led to experiment for themselves. A similar method of employing intelligent workmen is followed by the United States Steel Corporation.

Research is not conducted simply by intelligent young men, but by university graduates, as may be supposed. The work is so subdivided that often two chemists working side by side may know nothing of the problem as a whole.

When after countless trials and failures a discovery is made by a research chemist that seems to have commercial possibilities, a small experimental plant is erected in which the same type of apparatus which is to be used for actual work operation, is employed. The conditions are industrial conditions. Little factories are equipped with little autoclaves, little filtering presses, little hydraulic presses, and little vats. At a great coal tar dye factory near Frankfurt I saw new dyes being tested on a small scale which involved practically the erecting of a miniature leather dyeing plant, a miniature paper dyeing plant, and a miniature textile dyeing plant. Thus the suitability of newly discovered dyes for special industries was ascertained. Upon the dozens of scientific men in the laboratories of a manufacturing company a strict masonic secrecy is imposed.

The Masonic Secrecy of the Laboratory.

It is even said that the director of one part of a great chemical works is not permitted to enter another part, and that the exact salary of an important man may not be known even to his own wife. So far is secrecy carried that a chemist in one laboratory is frequently totally ignorant of the work done in another laboratory in the same building. He is not allowed, with rare exceptions, to read papers before learned scientific societies, at least not without the consent of the firm. Buried away in the files of the great companies are probably the records of countless experiments which, if made public, would unquestionably advance the whole cause of science. The individual steps, already taken, must be painfully retraced by university professors who are working for no commercial object. At Essen, for example, I was told that the problem of gun erosion had been so far studied in the laboratory that the Krupps considered themselves ten years in advance of America on that point, but when I asked a chemist if he could refer me to any scientific publication in which the Krupp experiments are discussed, I was informed that they had not been published and probably would not be published; that they were, indeed, in the nature of trade secrets.

The Business Management of a German Manufacturing Company.

A German company is usually managed by a board, at least one member of which is a scientifically trained man, thoroughly conversant with the technical operations of the plant. One of the directors may be a lineal descendant of the original founder of the factory. He bears the name of his ancestors and continues the traditions of the old factory so long as they meet modern requirements. Another director is a glorified salesman. He is a man who has traveled much, who knows government officers, who may ultimately win the title of *Kommerzienrat* and who may even win a seat in the Reichstag. All of these men speak four or five languages and speak them well. With them on the board sit men who have represented the company in foreign countries and who travel six months in the year establishing agencies all over the world.

As a result of this partition of labor it is difficult for one man on the board to overawe the others. The purely business men know nothing of science; they must rely upon the technically informed member of the board. On the other hand, the technical director knows little of business and must accept the views on finance uttered by those members of the board who are better informed on such subjects than he. As a rule the directors are all men between thirty-five and fifty. Keen, alert, thoroughly informed of business conditions in foreign countries as well as their own, students of international politics, they are, in a word, broad-minded, cultured business men of the finest type. Even the chemists and engineers on the board of directors are essentially commercial men—commercial in the sense that they meet the mechanical requirements of the world. More, however, is required in that respect of the German than of the American engineer. The German enters into direct competition with French, German and Austrian technologists, who save at their command labor just as cheap as his and just as plentiful. We find him, therefore, thoroughly conversant with every phase of the industry in which he is employed. Nothing escapes him. He knows the source of raw material, its price both to him and to his foreign competitors, the manufacturing processes adopted in foreign countries and their efficiency as compared with his own. He studies the idiosyncrasies of the foreign market, and seeks to adapt himself to them. He knows the transportation facilities as well as any shipping agent. He makes a study of tariff schedules and customs laws of foreign countries.

These men usually have at their command a huge capital, represented by bonds and stocks valued at anywhere from five million to ten million dollars. The dye stuff industry of Germany as a whole represents an investment of about seven hundred and fifty million dollars. There are surpluses and reserve funds that amount in several cases to over two million dollars. Dividends of thirty-five per cent are occasionally allotted.

Because there is more science in German than in American industry there is less audacity. The offhand way in which many American business men will sink a hundred thousand dollars in an enterprise about which they know absolutely nothing, simply on the strength of a friend's well-meant advice, is without a counterpart in Germany. But when the board of directors of a German company has thoroughly studied a problem with the aid of competent men, when, as a result of that study, they have become thoroughly convinced that in the solution of the problem there lies a commercial possibility, money is spent freely in researches that may extend over years before it is possible to erect the first manufacturing plant. Thus the Badische Anilin und Soda Fabrik spent about four million dollars, it is said, to develop the present method of making synthetic indigo on an industrial scale. But the pecuniary sacrifices thus made were not risked for work that might or might not succeed. The result was foreseen and inevitable. The company knew that, given time, money and brains, the problem could be solved. Every path was explored, every chemical reaction that could possibly be employed was tried, with the result that every chemist now knows.

Millions for Research.

So, too, the Badische spent thousands and thousands of dollars in developing the Schoenherr process for the reduction of atmospheric nitrogen. The late Heinrich von Brunck, who did much to bring the company to its present eminence, realized how important was the solution of the problem. He placed ample funds at the disposal of Dr. Schoenherr. The Badische Company needed sodium nitrite for the production of anilin dyes. Previously, sodium nitrite had been made by the reduction of Chile nitrate with lead; but this method of production was costly. On every acre of the earth atmospheric nitrogen to the amount 31,000 tons presses; for eighty per cent of the air we breathe is composed of nitrogen. At that rate the air over every nine acres contains about two hundred and eighty thousand tons, equivalent to the amount of Chile saltpeter used in 1907. It is no easy matter to utilize the nitrogen of the atmosphere, simply because it is inert, in other words, because it refuses to combine very readily with other elements. Schoenherr devised an electrical method of fixing the nitrogen of the air, which is now familiar to the readers of this journal. As a result of the Schoenherr process, sodium nitrite is no longer reduced from Chile nitrate. Practically the entire supply of the world, valued at about one million dollars, is now obtained electrically.

So, too, the contact process of manufacturing sulphuric acid was developed by the Badische Company because of the demand of the indigo and alizarin manufacturer for a cheap concentrated sulphuric acid and sulphuric anhydrid. The demand for cheap sodium and chlorine induced the company to develop the electrolytic soda process. In a word, even the raw materials of a great industry are now made by cheap and efficient processes, scientifically developed.

The amount of work that must be done in systematically developing an industrial process along scientific lines is herculean. New methods must be worked out before a way is at last discovered of attacking the problem in hand. The work is slow because the investigator must follow an unbiased path. To spend two hundred thousand dollars a year and have nothing to show at the end of that period may seem sheer madness. Yet the German chemist knows that given time, money and brains, he must eventually succeed, knows that the commercial returns from a single great discovery are enormous. Of seventy-five research chemists whose collective salaries may vary from $75,000 to $200,000 a year, seventy may discover nothing, while the other five may discover products that mean a net return of a hundred thousand dollars a year for at least the life of an ordinary patent. That explains why some of the German chemical products notably drugs, seem inordinately high in price. Dr. Eberhardt of the Badische Company put the matter thus: "If capitalists are to employ inventors or to take up the exploiting of inventions as their business, as a means of earning their dividends, they must be recouped from successful inventions for the losses which they inevitably will incur from unsuccessful ones. Success can be made certain only by taking a large number of chances. A firm employs, let us say, one hundred chemists and engineers for the purpose of making and working out inventions. Some of these will never make an invention, but their salaries have to be paid. Few can be relied upon to deliver a paying invention every year, but the expense of their laboratories and their income has to be assured. If these conditions, essential for the establishment of chemical industry, were better realized, there would be less talk of the exorbitant prices charged by patentees for their products, and the ideas of many people as to fair terms for licenses—compulsory or otherwise—would have to be rearranged."

(To be concluded.)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Defense of the Forest Service

To the Editor of the SCIENTIFIC AMERICAN:

My attention has just been called to the letter published in the SCIENTIFIC AMERICAN for June 1st under the heading "Comment on the Forest Bill." The bias of the writer is so obvious that I consider it unnecessary to make reply to most of his assertions; but certain passages in his letter compel attention.

Forest rangers are spoken of as "apparently imbued with the sole idea of 'riding' the sheep, cattle, and other industries therein, and principally the men who drive their stock across this country, or who have previously owned for years patented land around the water therein. In this way they make a part of their salary, while the rest comes out of the general Government."

This passage is so worded as to suggest that rangers are in the habit of levying on stockmen and others for their own personal benefit. What are the facts? The stockmen who graze their sheep and cattle on the National Forests pay the Government for the privilege, although they pay much less than it is worth and much less than they pay in the same regions for the same privilege on privately owned lands of equal grazing value. But all receipts from users of the forests are covered into the Treasury of the United States, while the salaries of all forest officers are paid entirely from the annual appropriations for the Forest Service made by Congress.

The writer also says:

"I think much money is now being unlawfully diverted and should be curbed, and wish you would interest yourselves in the matter further.

"If you want specific instances, I will furnish them."

I should certainly be glad to learn of any instances, specific or otherwise, of unlawful diversion of public funds.

It is one thing to criticise the national forest policy, concerning which there are bound to be honest differences of opinion and which, from the fact that it collides with the private interests of many individuals, is bound to be warmly debated; but it is quite another thing to indulge in reckless accusation of public officers. If I have allowed public funds to be mis-spent, I should be removed from my position. If forest rangers have been taking advantage of their position to practise extortion upon users of the national forests, they should be in jail. The writers of letters like the one which you published should, as a matter of public duty, lay their evidence before the officers who have power to institute criminal proceedings or to take the proper disciplinary action; or else they should retract their statements. There is no finer or more devoted body of public servants to be found anywhere than the men of the Forest Service, and in justice to them I cannot but protest vigorously against such imputations as your correspondent seems to wish to convey.

H. L. GRAVES, Forester.

United States Department of Agriculture, Forest Service, Washington, D. C.

[The letter of June 1st referred to by Mr. Graves was published without prejudice on our part, and we take much pleasure in presenting the above reply.—EDITOR.]

Maritime Canals and Restrictions on Size of Vessels

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN of even date is before me. On page 579 you have an item referring to Mr. Grunsky's report in reference to maritime canals and restrictions on the size of vessels. In order that your readers may be informed, I may say that Mr. Grunsky's recommendations were not approved. All the writers of the various reports, from several maritime nations, of which Mr. Grunsky was Reviewer, and who were present and some who were absent but were represented, unanimously protested against his "Conclusions," considering it to be the work of the International Navigation Congress to *promote* instead of to *restrict* navigation.

Mr. Grunsky presented five suggested "Conclusions," four of which were not accepted. The fifth was adopted as the sense of the Congress, which simply stated that a maritime canal should be five times as large as the immersed portion of the largest ship which is to use it, with a depth of one meter under the keel, these values being functions of the speed and somewhat of the volume of commerce, and are to be determined by local conditions.

ELMER L. CORTHELL, D.Sc.,
President Maritime Section of the Congress.

Bow Rudder for Ships

To the Editor of the SCIENTIFIC AMERICAN:

As many of the notable advances in various fields have been accomplished by a process entirely at variance with the customary and accepted way of doing things, I think my suggestion may not be as quixotic as it may seem at first glance. My idea is that a rudder should be at the bow of ocean steamships, in addition to the present one at the stern. If the "Titanic" had been so equipped, she would no doubt have been afloat to-day. The "Hawke" disaster would most surely have been averted. Let us follow the action of a rudder placed at the stern. If the bow is approaching an object, the action of a stern rudder is to swing the stern in the same direction as the object, and the bow is then pointed away, but before a rudder can point a boat away from any obstacle, the whole ship has been swung closer to it, which is the reason that it is difficult for a boat to swing directly away from alongside a wharf. Now let us follow the action of a rudder placed at the bow: On approaching an obstacle, the rudder would be turned away from the object, and would pull the bow of the boat directly away from it, and the ship would track after it, the same as an automobile does in turning a corner. In the case where the smaller boat was caught in the suction alongside a larger one, a bow rudder would have turned the bow away immediately, instead of which the stern rudder simply swung the stern of the boat in as well as the bow toward the larger boat. In the case of the "Titanic" a bow rudder would have drawn the bow aside immediately, instead of which the stern rudder in that case simply threw the ship partially broadside on the obstruction. Now this idea of placing a rudder at the bow will doubtless be criticised, and one of the first will be the objection to its exposed position. The rudder would not be damaged unless the ship runs into something bow on, a trick not appreciated by good seamen. Of course, the rudder would have to be hung somewhat differently from the stern, so that about three-fourths of it would follow the post, but I think it would be a simple matter to arrange the necessary details.

Toronto, Ont. A. C. LAWRENCE.

A New Phonograph

To the Editor of the SCIENTIFIC AMERICAN:

May I point out that the sound-recording apparatus of Mr. Lifschitz, described in your issue for April 27th, is not as novel as you seem to think it, as Mr. J. C. M. Stanton, Mr. R. C. Pierce, and myself constructed an exactly similar apparatus more than ten years ago. The greater portion of this apparatus still exists in my possession, as also one of the photographic records from which the reproducing strip was prepared, together with some of the latter.

As a delineator of the complicated curves which represent human speech, we found the photographic recording apparatus most efficient; but as a reproducer of sounds the system was not nearly so effective as the auxetophone of Sir Charles Parsons, which also operates by controlling the emission of air from a charged reservoir. Furthermore, the great length of ribbon that was required made the records unduly bulky.

London, England. A. A. CAMPBELL SWINTON.

The Fatal Aeroplane Accident at Boston

THE third Boston Aeroplane Meet, which was held from June 29th to July 7th, had a pall thrown over it at the close of the third day by the sudden death of its manager, Mr. W. A. P. Willard, and Miss Harriet Quimby, America's best-known aviatress.

The accident occurred at the close of a 20-minute flight to the Boston Light and back, which had been accomplished in a perfect manner by the skillful aviatress. She had risen, when at the farthest point, to a height of some 2,000 feet, and had been gradually descending all the way back. She had almost reached the field, and was at a height of about 1,000 feet, when the machine made a sudden dip and the body of her passenger, who had been seated in the rearmost of the two tandem seats, was thrown out of the machine and came hurtling to the earth. For a moment the pilot managed to right her machine, but the next instant it dived vertically and almost turned upside down, the result being that she too was thrown out, despite the strap which she had placed across the fuselage just in front of her waist.

As the two bodies fell with terrific speed and struck the water where it was only a yard deep, the aeroplane continued its plunge, but soon righted itself so that it descended at an angle of some 65 degrees and, striking in shallow water, turned upside down and remained on its back not severely damaged.

It is hard to find a plausible explanation of this terrible accident. Miss Quimby had flown her powerful 70 horse-power Blériot not more than half a dozen times, but she had never experienced any difficulty in managing it. On her first flight at Mineola, she used ballast in the shape of sand bags in the passenger's seat. She complained of the shifting of the sand, which she could feel when in flight, and afterward she never flew except with a passenger. Her machine was the latest military-type Blériot and she believed it perfectly safe as far as carrying a passenger was concerned, because the latter, being located some 4½ feet back of her own seat, could not interfere with her in any way—as had happened when the seats were side by side, with almost disastrous results.

As in the case of Moisant, who was flung from his machine as was Mr. Willard, the most plausible explanation of the accident seems to be gyroscopic force. A very slight difference in pressure against the front edge of the wing (which might be caused by a sudden turn of only a few degrees, occurring as a result of an "air hole" or of the pilot's foot slipping off the tiller) would, with the heavy 70 horse-power Gnome motor running at full speed, as it apparently was doing, develop a powerful and sudden force that would turn the machine instantly downward and whip the tail around through the arc of a circle so quickly that it might even break the fuselage. Eye witnesses agree that Willard was flung aloft and forward as from a sling, his body falling very close to the plunging machine, if, in fact, it did not hit the latter in its descent. This terrific gyroscopic force acts much more quickly and powerfully than does the force of gravity itself. Even a heavy, rapidly-revolving propeller on a non-rotary motor engenders sufficient gyroscopic force to put the aviator on his guard. In all probability many of the terrible accidents which have occurred with revolving-cylinder motors have been due to this unrecognized force, which takes the aviators unawares.

After Willard was pitched out, it appears to have been impossible for Miss Quimby to maintain the equilibrium of the monoplane sufficiently to make a safe descent. That she tried her best to do this, and that she succeeded for a moment, is seen in the fact that the aeroplane straightened out after its first dip and before its final plunge. It is also possible that the control post became jammed, owing to Miss Quimby reaching forward for something, or that it was thrown suddenly forward sufficiently to make the initial dive in this manner. It was in this way that Moisant made a sudden plunge to earth at Belmont Park one time when he was reaching forward to turn on the oil. There is also the possibility that a control wire may have broken, but as these were in duplicate this is very doubtful.

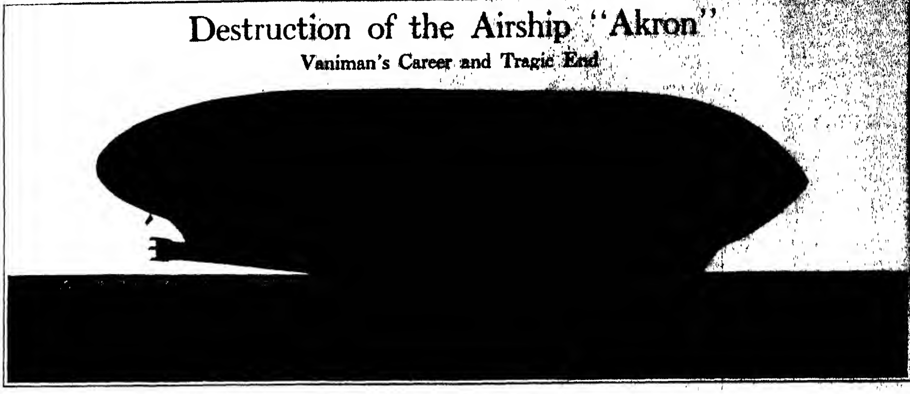
It is possible that a so-called hole in the air may have caused Miss Quimby's accident. The writer has a vivid recollection of seeing Earle Ovington suddenly tip to one side at an angle of 45 degrees when he experienced such a downward current over the edge of Long Island Sound at Bridgeport, Conn., over a year ago. Ovington saved the situation by diving, but he said when he alighted that had he not acted with the greatest celerity, and had he not been strapped in securely, he would have fallen to his death. The aeroplane in this instance tipped with great suddenness, one wing of the machine evidently passing into a swiftly descending current. In Miss Quimby's case, from the accounts of eye witnesses, it seems to have been a forward dive that pitched out the occupants of her machine.

Might it not be possible that this sudden dive was caused by the aeroplane striking a fast downward current head-on, even though it were going 70 to 80 miles an hour? At all events, such currents of air seem to be most numerous above the coast line, and aviators should be very careful when passing over it.

Miss Quimby, as the readers of the SCIENTIFIC AMERICAN are aware, had been flying for something less than a year. She learned to fly at the Moisant school at Mineola, under the tutelage of André Houpert; and only a day or two before she left for Boston, her former instructor had endeavored to persuade her to give up flying, as her sister aviatress, Miss Matilde Moisant, has done. She believed in the safety of the aeroplane if flown with discretion (and she never flew it otherwise), and it is certain that the accident which caused her death was not due to fancy flying or faulty manipulation of the machine by her in any way. Miss Quimby was the first woman to fly across the English Channel, a feat which she performed on April 16th last, as already described in these columns. She was a self-made young woman, of gracious personality, who had endeared herself to the staff of *Leslie's Weekly*, of which she was a member, and to every one in the aviation fraternity. Miss Blanche Scott, the only aviatress we have remaining, was flying at the Boston meet at the time of the accident. She did not give up on account of it, but continued to fly every day until the end of the meet.

Destruction of the Airship "Akron"

Vaniman's Career and Tragic End



The airship "Akron" on one of its trial trips maneuvering close to the water.

AMERICA'S only airship vanished in a flash of smoke at 6 38 in the morning of July 2d, and with it perished America's only aeronautic engineer with his crew of four men The accident, although viewed by three thousand spectators along the shore of Atlantic City, will ever remain a mystery, for not a soul aboard the vessel survived. Eye-witnesses of the disaster speak of a wreath of smoke that appeared, followed by a caving in of the gas bag. An instant later there was a loud explosion that burst the envelope, and the car dashed down into the sea, where it fell a heap of wreckage in water a few feet deep.

The cause of the disaster is open to conjecture It seems to be the general opinion that it was due to rapid expansion of gas under the heat of the sun, although it is not clear that there was much variation in temperature while the airship was in flight The "Akron" was brought out at 6 15, and took to the air without mishap Apparently everything was running smoothly and a number of maneuvers were executed successfully. After a time it was seen to rise to a considerable height, and it was apprehended that Mr Vaniman was having difficulty in bringing the dirigible down. Possibly, and this is a mere surmise, Mr. Vaniman attempted to bring the airship down by pumping air ballast into the ballonets. Possibly he had miscalculated the strength of his envelope, or his pressure gages may have been incorrect or else his safety valve may have jammed. At any rate, it is probable that a serious leak developed and that the hydrogen was touched off by the redhot exhaust gases from the engines

When the "Akron" was being built last fall, great secrecy was preserved concerning the fabric employed Every scrap and clipping of the material was carefully preserved and kept from the hands of souvenir seekers. It came out afterward that Mr Vaniman placed great hopes in this fabric, for it had been made many times stronger than the ordinary fabric used in a dirigible balloon He hoped thus to prevent expansion of the balloon with every slight variation in the temperature of the gas and to obviate the necessity of releasing gas when the balloon arose into the rarer atmosphere of higher levels When the "Akron" received its first test in the flight of November 4th, last year, Mr Vaniman found that this principle was correct and he succeeded in making the dirigible rise and fall by subtracting or adding to the air ballast he carried in his ballonets For instance, if he wished the machine to come down, he would pump air into the ballonets, compressing the gas and making the balloon heavier without increasing its displacement His idea then was to pick up water ballast from the ocean in what he called a "hydro levator" Although the flight ended in a mishap, the experiments were successful and led Mr Vaniman to the invention of the "wire wound" dirigible balloon, that is a balloon made of a fabric reinforced with steel wire

A description of this balloon appeared in our issue of February 17th The idea was to use, with the cotton thread, steel piano wire no thicker than the thread, weaving the two together in a loom of special construction. The wires were to be of continuous length from end to end of the balloon and the fabric was to be laid on in two layers, one running longitudinally and the other spirally about the balloon. By placing the wires a tenth of an inch apart in one of the layers and a twentieth of an inch apart in the other, he was able to make a fabric so strong that it would resist a pressure of 52 inches of water against $1\frac{1}{2}$ inches of water in the "Akron," and less than half an inch of water in the ordinary balloon. Thus by making the bag thirty-five times stronger than that of the "Akron" he would be able to prevent it from expanding even though the temperature of the gas within rose fifty Fahrenheit degrees. On an airship of the size of the "Akron," the weight of the steel wire would have added about two and a half tons, but this would have been a small price to pay for the absolute stability obtained. It would then be a simple matter to bring the dirigible down by pumping air into the ballonets and then to raise the dirigible by releasing the air from the ballonets. The task of constructing such a balloon is no small one, and many problems arose, but Mr. Vaniman showed remarkable ingenuity in solving them. We are informed that he had ordered a loom and was about to begin the actual construction of the new balloon at Atlantic City when the disaster occurred.

The "Akron" was the first American-built dirigible balloon to compare favorably with the highly advanced practice in Europe. All our other dirigible balloons have been mere toys in comparison. The Wellman airship was not an American-built vessel, but was first constructed in France for the Arctic expeditions, and then merely reconstructed in this country for the transatlantic venture. The "Akron," however, may be considered the first and only airship worthy the name that this country has ever produced. It was 258 feet long, 47 feet in diameter, and had a capacity of 400,000 cubic feet. It was provided with three engines, two of 100 horse-power and one of 80 horse-power, which were designed to propel the craft at a speed of 30 miles per hour when all three pairs of propellers were operating at the same time. The two after pairs of propellers were arranged to be swung about at such an angle as to drive the airship up or down as desired. In addition to this there were planes fore and aft which could be used for steering the vessel vertically. As in the Wellman airship, the car was built in contact with the under side of the gas bag instead of being separated by a considerable space, as in all other types of non-rigid dirigibles. This served to stiffen the structure, but brought the highly inflammable hydrogen into close proximity with the engines. Possibly this daring design may have been the cause of the disaster.

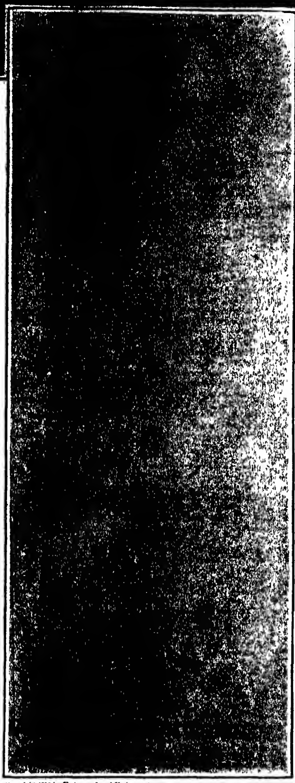
Melvin Vaniman met his death in the prime of life, at the age of forty-five. He was born at Virden, Ill., near Springfield, on a farm. His father, an Ohio man, was one of the pioneers who opened up that section. The first sixteen or seventeen years of Vaniman's life were spent upon the farm; subsequently he went to college at Mount Morris, near Chicago, and at Valparaiso, Ind. He then took up the study of music at Chicago, and was for a time active on the stage as an opera singer. It was upon these operatic tours that he began to carry a camera with him, which, as events subsequently turned, strangely enough proved to be the first cause of his entering the field of aeronautics.

This opera company with which he was traveling made a western tour to San Francisco and Honolulu and was overtaken by ill fortune, a plague scare having broken out in Honolulu, which so affected the commercial situation that the company was dissolved. Mr. Vaniman, therefore, looked about him for some business opportunity, and his services were engaged by a steamship company, which took him on one of its tours to prepare photographs of the scenery *en route*. In this way Vaniman visited New Zealand. Here he prepared photographs for the New Zealand Tourists' Department, and his collection was of such excellence that it was exhibited at the St. Louis World's Fair, and received a gold medal, the highest award. Vaniman had constructed a special camera for his work, which enabled him to prepare very large, panoramic pictures. It is this camera which, by a peculiar trend of events, proved the first cause of Mr. Vaniman's interest in balloons. In order to obtain his pictures he was forced to seek out elevated points which were often not easy of access, such as the tops of trees, masts and similar inconvenient places. He, therefore, conceived the idea of making use of a captive balloon for his purposes. This plan took him to London, Paris and Rome. The captive balloon, however, still had this inconvenience; it had to be launched from the neighborhood of gas works. An obvious way to overcome this difficulty would have been to employ a dirigible air-craft. Hence, Vaniman, with his resourceful mind, turned his thoughts to the construction of aeroplanes, upon which he worked for some time, finally turning out a machine which proved to be ill-fated, and was completely destroyed in one of the trials in landing.

The "Akron" emerging stern first from its hangar.

The next event of interest to be chron-

Examining the wreck of the "Akron".



The disrupted envelope falling to earth.

The gas bag afloat at Absecon Inlet.

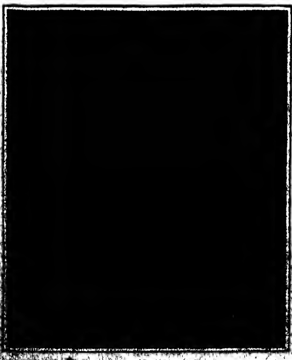
[...]ieled in Vaniman's life is his introduction to Mr. Wellman, who had just finished his first polar campaign and was preparing for a second. Offers of plans for a dirigible balloon for the second expedition were called for, and Vaniman's designs were the ones chosen and he himself appointed chief engineer. He went north in 1907 and spent the summer building the balloon. Two trips were made with this balloon; the first time the crew was lost in a snowstorm, and landed in a glacier. The second trip was hardly more successful, and was brought to an abrupt and early conclusion by the tearing off of the equilibrator, which in this instance was ballasted with food and provisions for the party. The expedition, therefore, had to be abandoned. Peary's discovery of the North Pole put an end to further attempts at Arctic airship expeditions, and the next venture was the Wellman transatlantic expedition.

The crossing of the Atlantic by airship has seemed such a foolhardy undertaking that the public has been inclined to consider Mr. Vaniman a mere reckless adventurer. He was more seriously taken when he actually made the attempt. The public was quick to grasp the fact that Mr. Vaniman was the moving spirit in this expedition and the engineer to whom all credit for the partial success was due. The attempt was not an utter failure. The "America," as the airship was called, stayed in the air 71½ hours, establishing a record for dirigible balloons, and covered 1,008 miles, which was also a record. The equilibrator, or floating drag, retarded the airship to such an extent that it could not keep up with the winds that were carrying it across the Atlantic, and yet without the equilibrator the airship surely would have been lost on the third day out. As was stated in the SCIENTIFIC AMERICAN at the time, when the "America" was abandoned it was structurally just as sound as when it put out from Atlantic City, except that one of the propellers was disabled.

When a member of the editorial staff of the SCIENTIFIC AMERICAN visited Mr. Vaniman after his rescue from the "America," and questioned him on the object of such a venture, Mr. Vaniman was careful to explain that it was not from choice that he had undertaken the trip. He felt that the dirigible balloon was being entirely neglected in this country, and that it ought to receive far more attention than the aeroplane. He knew that only by accomplishing something of a startling nature could he arouse his countrymen to the value of this form of aerial navigation, and he stated that if he could arouse equal interest in some other way, he would rather do so. He realized the hazards of navigation in a dirigible balloon, but was sure that they would yield to study and experiment. When the idea of wired fabric occurred to him he was confident that the problem of safety in the air was solved at last. He never made extravagant claims for aerial navigation. He did not believe that the dirigible balloon could ever be used for transporting mail or express matter or for carrying people from place to place on scheduled time, since so much depends upon the direction of the wind. However, he did expect to see the time when stable wire-reinforced balloons would be used for pleasure trips and vacation tours. It is a pity that his life was not spared to complete this new balloon and demonstrate its usefulness. We are inclined to believe with him that it held out unusual promise of success, and unfortunately there appears to be no one else in this country with the ability and experience to carry on his work.

Radio-activity of Human Organs

DR. COARNS, of the Heidelberg Institute for the Study of Cancer, has succeeded in obtaining experimental evidence of the radio-activity of various human organs. The first experiments were made by allowing the organic matter to act through a wire grating, on a photographic plate wrapped in black paper. Faint radiographs were obtained by twenty-four hours' exposure, the strongest action being exerted by the substance of the brain. In order to prove that the observed effects were really produced by radio-activity of the organic substance, portions of the brain, heart, liver, spleen and lungs of twelve cadavers were incinerated and their radio-activity was tested with Becker's emanometer, by measuring the rate at which the electrometer of the apparatus lost its charge under the influence of the incinerated substance. In most cases, one gramme of the substance produced more or less conductivity in the air. The brain was found to be the most strongly radio-active organ. A surprisingly great effect was produced by the incinerated brain of a person who in life had drunk large quantities of radio-active water for the alleviation of abdominal pains. The kidneys and the spleen were uniformly found to be the least radio-active of the organs examined, and the liver and the heart also showed little radio-activity. In two cases the substance of the lungs was tested, and was found to possess a comparatively high radio-activity. The number of measurements is too small to allow definite conclusions to be drawn.



[illegible], assistant navigator, at the wheel.

Melvin Vaniman.

Within the narrow car of the "Akron."

The soil receiving a heavy application of lime required for alfalfa growth.

ALFALFA, perhaps the oldest of all our cultivated forage or hay plants, has had a history scarcely less interesting than that of the many nations which have utilized it. Such nations have prospered almost in direct proportion to the extent to which they have used it. The name "alfalfa" comes from the Arabs and means "the best fodder," and in fact it appears to have originated in Media or in some adjacent country, as the folklore tales from lands on different sides of this area point toward Media as the place whence it came. Although in its original state it must have had a narrow range of adaptability to varying climatic and soil conditions it has by successive stages come to be adapted to portions of every continent. Even in this country it grows below the sea level in southern California, where the climate is among the hottest in the world. In Colorado it may be seen in full vigor at altitudes above 8,500 feet. In latitude it is equally cosmopolitan and may be found growing from Mexico to Canada as well as in tropical America. The eastern half of the United States has presented a serious combination of circumstances working against its successful production. A brief survey of its early history and migrations may assist in explaining some of the reasons why the culture of alfalfa in the East has met with so many difficulties and why so many points must be safeguarded to assure success.

Alfalfa in Ancient Times.

The wars of the Persian Invasion of Greece took it to the latter country about 590 B. C., it being the custom for the advance emissaries to precede the army and to plant fields for the sustenance of the herds which helped support the invading hosts. From Greece it advanced to Italy and Spain by successive stages and was taken to Old Mexico by the Spaniards about 1519 A. D. From here it was carried to South America and later (1854) entered California through the Golden Gate at the time of the activities incident to the discovery of gold in that State. Thence it spread over the irrigated sections and more recently has continued its march eastward until now it is by far the most important forage crop of such States as Nebraska and Kansas, the latter having approximately a million acres as compared with a very few thousand two decades ago.

The eastern march of alfalfa halted, however, when it encountered the humid belt beginning with Missouri and extending eastward to the Atlantic ocean. Alfalfa was developed under scorching suns and in sections almost devoid of natural rainfall and the unnatural conditions presented by a country where the rainfall is at all excessive constitute a great handicap to its successful production. The increased rainfall causes most soils to be poorly drained and these are usually sour or "acid" in character. Both the poor drainage and acid condition of the soil prove harmful to the plants. This is by reason of the prevention of the growth of the nitrogen-gathering bacteria which are so essential to the welfare of the alfalfa plant itself and which enable the roots to accumulate vast stores of the costly nitrogen from the air, free of charge to the farmer. As has been said these bacteria not only work for nothing and board themselves, but they actually pay something for the privilege of living. They must, however, have the proper soil conditions and these are not naturally present on the ordinary farm in the Eastern States.

Requirements of Alfalfa.

Alfalfa requires a deep, fertile, well drained, well limed, thoroughly inoculated, acid-free soil. This list of requirements is long, but it means a great deal to the ordinary farmer, who usually is unable to immediately provide these conditions for alfalfa. In order to emphasize the necessity of each of these, it is necessary to treat them somewhat in detail.

A deep soil is necessary by reason of the great root development which the alfalfa plant makes. In the West the plants have been known to send down long roots for more than 30 feet into the deep, friable, alluvial soils. It is not able to make its normal growth and compete with the surface-feeding weeds if there is not present a soil sufficiently deep for its roots to penetrate and draw up the hidden stores of plant food which are necessary for the numerous crops of nutritious forage and which are out of the reach of the less deeply rooting plants. At least four feet of good soil is usually necessary unless the underlying formation be limestone, in which case, three feet has been found to suffice. The plants will, however, utilize the ground to a much greater depth if opportunity is presented for them to do so.

A fertile ground is necessary, since the hay it produces is among the richest we have and calls for the extraction from the soil of large amounts of plant food. It is a mistake to think that because it is a legume and has the power of adding nitrates to the soil that it can be seeded on land poor in the other essential elements of fertility. It cannot add phosphoric acid or potash to the soil on which it grows; and yet it requires large quantities of these elements in order to produce paying crops of hay. This fertility may be brought into the soil by the use of green manures, commercial fertilizers or by the application of a liberal dressing of barnyard manure. The last method has been found to be usually the most satisfactory as, apparently, the manure offers the conditions required by the bacteria which live on the roots of the alfalfa.

A well-drained soil is essential as the roots can not stand lack of drainage, nor can the bacteria which ordinarily live on its roots, exist in the absence of a well aerated soil.

Liming is necessary on all soils deficient in this mineral, as in the presence of acid conditions neither the bacteria nor the alfalfa itself can succeed.

It is also necessary to have the soil thoroughly inoculated with the nitrogen-fixing germs in order that each plant may be well provided with these organisms for abstracting the nitrogen from the air and converting it into a form available to the alfalfa plant.

A weed-free soil is desirable, especially a soil free from perennial weeds which cannot be eradicated by mowing. The annual weeds may be best avoided by seeding the alfalfa in the late summer which allows the plants to attain a fair size before winter. The stand of well grown plants the following spring will do much toward preventing the development of any freshly germinated weeds. It would, therefore, appear that it is possible to raise alfalfa in many parts of the Eastern States, in case proper attention is given to the selection and preparation of the ground. A number of years may be required to develop a poor field to the proper richness to hold the stand of alfalfa.

On account of the rather peculiar and exacting requirements, respecting soil and fertilizers, as well as the high price of the seed, alfalfa is not what may be called a "poor man's crop;" neither is it a crop for a run-down or unfertile farm. Its present uncertainty on many types of soil should also retard the man of limited financial means from going into its production on an extensive scale at first.

It is suggested that an experimental acre be established and divided into a number of subdivisions. Each subdivision should be given a different treatment as regards fertilizing, liming, time of seeding, rate of seeding and preparation of the soil. Each one of these plots will answer at least one question regarding the effect of a particular method of treatment. In this way the information which would otherwise require a number of seasons to procure, can be obtained at the end of the first year. The treatment proving best adapted to the particular conditions present can be applied to a larger area the succeeding season. In this way alfalfa can, if shown to be adapted to an individual farm, become established on that farm at the least possible risk to the owner or worker of the ground. The first seeding will usually furnish an abundance of soil for inoculating the subsequent seedings of alfalfa. This utilization of soil from one's own farm avoids the danger of introducing weeds and plant diseases from other sections.

Enemies of Alfalfa.

Weeds as might be expected constitute, perhaps, the worst enemy of alfalfa, and among these crab grass probably ranks first. Alfalfa does not make a vigorous growth during the midsummer in most parts of the East, and it is during this season of the year that the crab grass and other weeds make their most luxuriant progress. Unless there is an abundance of plant food in the soil to produce a luxuriant development of alfalfa the plants are apt to become soon reduced in vitality as to be unable to resist the crowding of the weedy grasses; so much so, in fact, that they may not be able to make a sufficient recovery for the succeeding season's growth. The weeds must be controlled. This is best accomplish by seeding the alfalfa in the late summer or early fall on land that is comparatively free from weeds and has been rendered even more nearly free from weeds by repeated harrowings; and, second, by maintaining the alfalfa in a sufficiently vigorous condition so that the weeds will be unable to obtain a foothold in the field. In actual practice it is seldom possible in the East to hold a stand of alfalfa for more than three or four years owing to the vigorous incursions of the more aggressive weeds. On limestone soils blue grass is very apt to crowd out the alfalfa plants. On other soils crab grass seems to take front rank among the alfalfa enemies. Plant diseases are always preying on alfalfa. These are especially troublesome when the vigor of the alfalfa is reduced by growing in soil not perfectly adapted to it.

Spring Seeding Versus Late Summer Seeding.

Much money and effort has been and is still being wasted by seeding alfalfa at the wrong season of the year. Many experiments have indicated that spring seeding, except in the extreme North, is a dangerous practice. The young plants are of a slow growth at first and as a consequence are easily crowded out by the more aggressive weeds in the late spring and early summer. The seeding should take place the middle of August in the latitude of Maryland and Virginia. Every hundred miles north calls for the seeding to take place one week earlier, while for every hundred miles south the seeding should be delayed for one week. If the land has been plowed and frequently harrowed for six weeks or two months before seeding, the plants will frequently produce a growth of ten to twelve inches before cold weather. This comparatively heavy

growth of alfalfa checks the growth of the winter growing weeds while the alfalfa plants are of sufficient size to make a rapid growth the next spring, and under ordinary circumstances will keep ahead of the weeds until the first crop is harvested. It is not usually possible north of the Potomac or Ohio rivers to turn under grain stubble in time for the middle of August seeding of alfalfa. A crop of early potatoes, however, can usually be removed in ample time for the seeding of the alfalfa since the ground does not require replowing and no time is lost in waiting for the ground to settle sufficiently to permit planting.

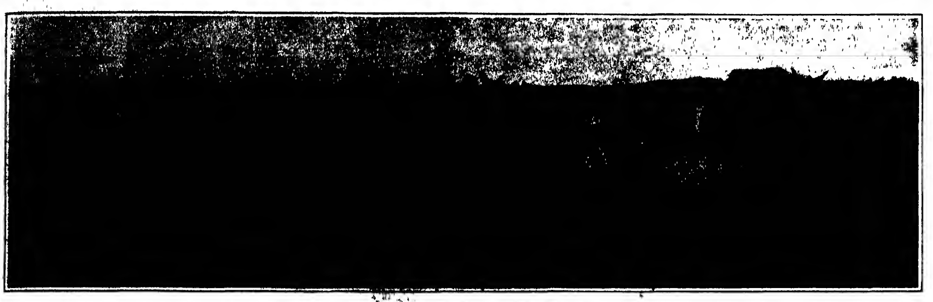
Harvesting the Alfalfa Crop.

Alfalfa gives several cuttings during a season. Every cutting should be made just as the crown of basal buds are starting the growth of the next crop. This will usually happen just as the plants are coming to bloom, at which time they range from 14 to 40 inches in height. The hay should be cured without shattering any more of the leaves than is absolutely necessary. The leaves are by far the richest part of the feed and every effort should be made to retain them. The hay is raked into windrows as soon as the leaves are well wilted and before they get so dry as to shatter. The hay should lie in the windrow until the leaves are dry and the stems still green, when it should be placed in shocks and allowed to cure before being placed in the barn or stacked.

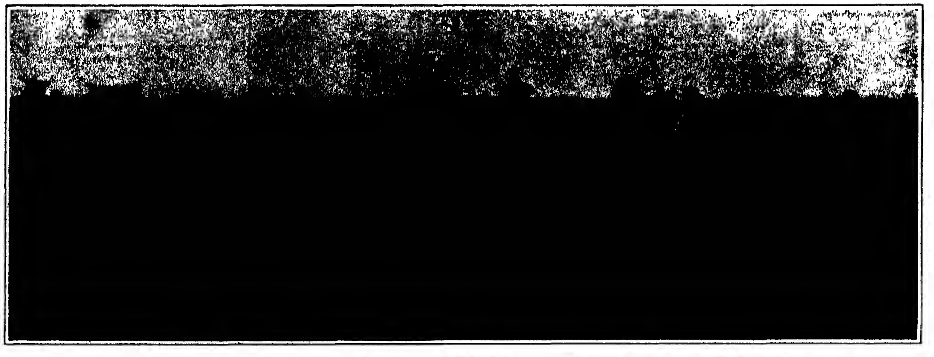
Value of Alfalfa for the Dairyman.

Alfalfa is a friend of the dairy farmer by reason of the marked effect of alfalfa hay on the production of both milk and butter, and also by reason of the excellent effect of the manure from the cow stables upon the growth of this really wonderful forage plant. It is for dairy farms especially that this crop is recommended in the Eastern States. Here, with an abundance of good barnyard or stable manure, the fertilizing bills are greatly reduced, while the cost of concentrates, which usually eat into the profits of the dairy farmer, is reduced to a minimum. With plenty of alfalfa hay for feed it is usually unnecessary to feed any of the high-priced concentrates in order to maintain a profitable flow of milk throughout the year.

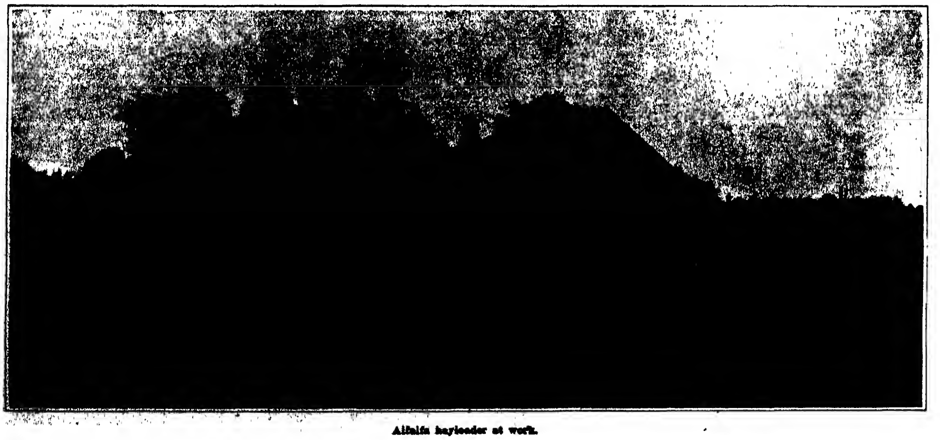
The following ten commandments regarding the culture of alfalfa are important for the prospective alfalfa



Mowing alfalfa in a one hundred-acre field on a Virginia farm.



Inoculation is necessary. Here the harrows cover the soil from some old alfalfa field before the sun's rays can harm the germs.



Alfalfa hayloader at work.

grower to consider. Don't fail to provide for ample inoculation; soil from a healthy weed-free alfalfa field is best. Don't sow poor or weedy seed. Don't sow on a weedy soil. Don't sow on any but a sweet, well limed soil. Don't sow on poorly drained soil. Don't sow on any but a finely prepared, well-settled seed bed. Don't pasture the first or second year. Don't lose the leaves, they constitute the best part of the hay. Don't seed a large acreage to begin with. Experiment on a small area first. Don't give up. Many prominent alfalfa growers finally succeeded only after many failures.

Pedesis in the Metal Uranium

RECENT discoveries in regard to the movements of the alpha particle in radioactive substances have awakened a new interest in an old phenomenon, pedesis, or the Brownian movement. In the pollen grains of plants there are fine granular particles called *forilla* which are set free when the pollen is crushed, and under a high power microscope they exhibit a movement which originally was believed to be analogous to the motions of the spermatozoa of animals.

But in 1827 Dr. Robert Brown observed that many inorganic substances in a fine state of trituration similarly behave.

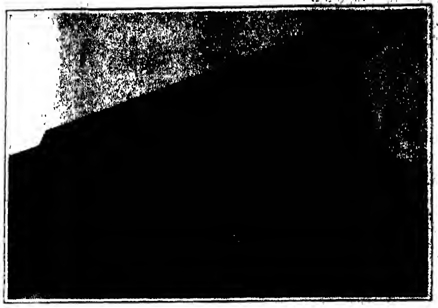
The movement is chiefly of an oscillatory nature, but the particles also rotate backward and forward, on their axes, and even dart above the field with a rapidity depending, of course, upon the power of the objective. Pumice stone, kaolin, gamboge and finely divided clays show the phenomenon very well, but they must be finely powdered, preferably in an agate mortar. Particles greater in diameter than 1/5500 of an inch are inactive, and it may be said that as a rule, and other things being equal, the finer the particles the more distinct the movement, which is about 1/5000 of an inch at each bound. Of all substances, and the writer has tried hundreds, the metal uranium shows the movement most distinctly, and in a manner almost spectacular. Pure uranium should be used, and pounded in an agate mortar for 15 or 20 minutes, or at least until many of the particles are reduced in diameter from 1/10,000 to 1/20,000 of an inch. Put on a slide a quantity of the powdered material, equal in bulk to a mass 3 or 4 times the head of a pin, add a drop of distilled water with a trace of gum arabic, and observe with a 1/12 oil immersion objective. The whole field seems to quiver with life, and the finer particles dart from point to point with a motion strikingly analogous to that displayed by many micro-organisms.

When the film of the material is of proper thickness and the particles sufficiently reduced in diameter the phenomenon is beheld in a perfect *abandon* of color—the reds and blues being of metallic brilliancy.

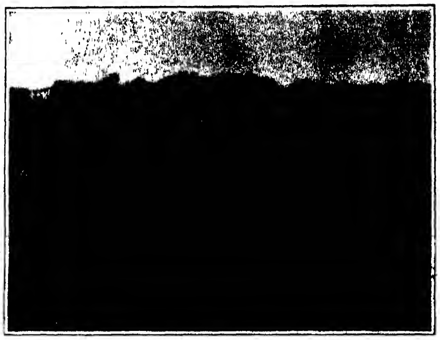
The result will well repay one for the effort expended in reproducing this experiment, and, once seen, it can scarcely be forgotten.

The Utilization of Atmospheric Nitrogen

THE importance of nitrogenous compounds to the agricultural and industrial interests of Europe and America has prompted the Bureau of Manufactures to issue a monograph on the subject of utilizing atmospheric nitrogen in the production of such compounds. The nitrogen problem, one of the most pressing of the twentieth century, is unique from the fact that the material is unlimited. The atmospheric nitrogen above one square mile of land, amounting to about 22,000,000 tons, is equivalent to what the world would require in the next fifty years at the present rate of consumption. The problem is to utilize this nitrogen economically, and thus free the world from its dependence on the nitrate deposits of Chile, which are not particularly extensive and are likely to be exhausted at a comparatively early date. Remarkable results have been obtained in Norway by means of electric furnaces in which atmospheric nitrogen is oxidized to the form of nitric oxide, which is used in making calcium nitrate, or Norway saltpeter. This Norwegian product is already an important rival of Chile saltpeter, but as the success of the process depends upon a very cheap supply of electricity it will probably not be used to any great extent in the United States until the furnaces have been made more efficient. Cyanamide, another nitrogenous fertilizer of growing importance, is being manufactured in America and the industry should prove successful, as the production in this country of the calcium carbide required by the process is second only to that of Norway. The monograph describes in detail the results obtained by the leading European chemists in their efforts to increase the supply of nitrogenous compounds, and the commercial as well as the technical aspects of the new industry are dealt with at length. The author, Thomas H. Norton, consul at Chemnitz, Germany, on detail as commercial agent of the Department of Commerce and Labor, states in conclusion that the achievements of applied chemistry make it possible for American industry and agriculture to face with confidence the threatened exhaustion of the nitrate deposits of Chile.

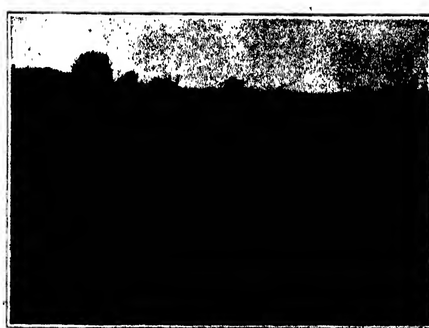


Large hay forks unloading alfalfa a quarter of a ton at a time.



Crimson clover is often used to turn under for enriching the land and bringing it up to alfalfa pitch.

The use of large side delivery rakes leaves the fresh cut alfalfa in shape for the hayloaders.



Removing soil from an old field for use in inoculating a new one.

Open-air Schools of Paris

IN the schools of Paris and other large cities the statistics show that there are on the average 15 per cent affected with tuberculosis, and although this may yet be in the latent state there is none the less a considerable danger for these persons for the future. Open-air schools are advocated for preventing the disease, and Messrs. Parmentier and Bernheim treated the question at the recent Tuberculosis Congress, stating that children so affected had the greatest benefit from their stay in such schools without suffering any drawback to their instruction. In the suburbs of Berlin a method of this kind is carried out in schools where the pupils are not lodged in the buildings. A type of boarding school is found in the suburbs of Paris, and the children are first examined so as to find out how long a time of stay will be of benefit to them. They are divided into groups according to their condition, and are also treated for defects in hearing or in the respiratory passages. The main treatment is a rational method in which open-air work and physical exercise play the most important part. Figures show that the results are excellent, and among the 800 pupils passing through the Vesinet school for the last two years, a great number starting from very bad health conditions received great benefit from even a few weeks stay in the open-air school.

Uses of Seaweed

SOME interesting facts about seaweeds which are used as food or for producing vegetable gelatines or glues, are brought out by Messrs. Perrot and Gatin in the annals of the French Oceanographic Institute. Seaweeds are not much used in Europe except for alkalies or iodine preparation. In the north coast regions of France the seaweed is used by the peasants as a manure upon the fields. Medical uses can be mentioned, and the variety called Iceland moss is collected in Brittany to a considerable extent, this reaching 20 tons of dry seaweed in 1904. One variety of seaweed is a very good vermifuge, and is extensively used for this purpose in Corsica. On account of the iodine which they contain, some seaweeds are remedies against goitre and scrofula. As to food uses, this seems to be limited to the Brittany region and only the poorer population consumes it. Although limited in Europe, the use of seaweeds as food is widespread in the extreme Orient. In Japan, edible seaweed is prepared in a number of ways and it is much cultivated. Iodine is not manufactured in that country at present. One use is for preparing agar-agar, glues and vegetable gums. Seeing that the gelatines from this source are scarcely nutritious, the authors explain their extensive use by the manner of living, and as the population consumes great quantities of fish and rice it is thought that the gelatinous substances aid in digestion and in the intestinal functions. It is valuable for alimentation and export.

Wholesome Water in the Country

The Dangers of Pollution and How They May Be Avoided

By Frederick H. Billings, the Associate Professor of Bacteriology at the University of Kansas

[PROF. FREDERICK H. BILLINGS is a man of considerable experience in matters relating to water supplies, this having been a part of his work in Kansas. He has been professor of botany and bacteriology in the University of Louisiana, 1901 to 1907, and associate professor of cryptogamic botany and bacteriology at the University of Kansas, 1907, and at the coming season is to be head of this department. He received the degree A.B. at Leland Stanford University, 1896; A.M., Harvard, 1897; and Ph.D., Munich, 1901. He has been bacteriologist to the Department of Water and Sewage of the Kansas State Board of Health. Much of his investigation and work have been along the lines of milk and butter. In addition to his regular studies Dr. Billings has taken two summer courses in bacteriology at the Harvard Medical School and one in dairying at the University of Wisconsin. At present he is at the Massachusetts Institute of Technology, where because of his high standing the courtesies of the laboratories and lectures are tendered to him. On his return to Kansas, besides his academic duties he will assume high responsibilities in the care of the State Analysis of Water.—EDITOR.]

From very remote times, a good water supply has been considered one of the greatest blessings since the fight of Isaac's herdsmen for the wells of Gerar down to present-day irrigation. Its possession has been subject to contention. Possibly good water was of more frequent occurrence among patriarchal tribes in their nomadic life than in our modern settled habitations. At all events, the growth of civilization has pressed upon us the problem of combating the contamination of water supply.

How the Quality of Water is Judged.

The quality of water has generally been judged by its degree of sparkle, of turbidity, of temperature, and, since the introduction of soap, of hardness. These standards have their value, but they are considered by sanitarians to be superficial criteria for determining wholesomeness. Water may be hard, warm, flat and turbid and yet be safe to drink. It may also be soft, cold, clear and sparkling, and still carry infection. Wholesomeness depends upon comparative absence of salts and organic matter, deleterious to health. Injurious salts, while inducing disturbances of a more or less discomforting nature, even causing permanent injury if long-continued, do not create such serious consequences as polluting organic matter, especially if this takes the form of pathogenic micro-organisms.

It is believed that decaying animal refuse, draining from garbage heaps, barnyards, piggeries, manured fields, cesspools, privy-vaults, and the like, may occasion sickness when it finds its way into a water supply; but an equal degree of danger does not exist in all of these sources of filth. Animal manure and garbage are in a class by themselves in that they are not liable to contain the germs of disease that would produce infection in man through water. Cesspools and privy-vaults are in another class, since they are open to infection by bacteria particularly pathogenic for man. Water containing such germs assumes its most menacing aspect, especially if under the insidious guise of a cold and sparkling beverage.

It would be desirable, of course, if every source of water supply could be examined by a sanitary bacteriologist in order to determine the liability of contamination; but so huge is the task that the solution of the question in many instances must be left to the intelligent judgment of the resident himself. Bacteriological analysis, moreover, though the most reliable we have, may fail at times to tell the whole truth, especially if too infrequently made. Such analysis is concerned usually with the detection of the colon bacillus, an intestinal organism indicating fecal contamination, and condemning water by its presence, because of occasional association with infectious microbes of the same habitat. Of such, one kind is the well-known *Bacillus typhosus*, the source of typhoid fever, which, in this country, is the principal water-borne disease. Its germ is found in the intestines of typhoid patients, of convalescents, and for a while, of those who have fully recovered. It is believed, also, to occur sometimes in healthy people who have never been known to have had the fever. The excrement of all such individuals is laden with the specific organisms, and becomes exceedingly dangerous to others, if its disposal is improperly cared for. In rural districts, it usually finds lodgment in privy-vaults, cesspools, or on the ground, from any of which, permeations or washings containing living bacilli may find their way into some water supply. As the specific germ of typhoid is known to emanate only from infected persons, who constitute but a small percentage of the average community, the majority of country water supplies, even though otherwise contaminated, would be incapable of creating an outbreak of this particular disease. Typhoid, moreover, is not limited to water as a means of transmission, for contact and infected food play their part. But, after all has been said, it still remains true that water has often been a serious source of infection, causing numerous epidemics and disastrous loss of life.

The Water Supply of the Average Man.

The average man, when confronted with an adverse analysis of his water supply, is liable to be surprised, declaring that it is the best in the country, and that it has been used for years without producing illness. Granting that he be right, immunity in the past is no guaranty, unfortunately, for the present or future. In his case, some connection has evidently become established between well and outhouse or cesspool, and apparently he has not happened to harbor a typhoid-infected person on the premises. There is nothing needed now but the carrier of the specific organism to begin the trouble.

Rural water supply is generally obtained from springs, wells or cisterns. From a sanitary standpoint, springs and deep wells—deep in the sense of penetrating below the first impervious stratum—are the most reliable sources. The usual excellence of these, and, in fact, of all good ground water, is largely due to the filtering property of the soil. Springs, especially those flowing through fissures, and deep wells reap the benefit of prolonged filtration through earth. But both may be subject to contamination, particularly springs, which are often open to surface washings from sewage-drains, and the like, located farther up the slope. Hence it is advisable to inspect the watershed above a spring; also, to guard it from the surface washings by a wall or ditch.

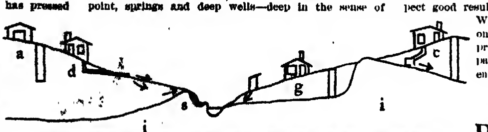


Diagram illustrating relations between water supply and sewage disposal in the country.

a, Stable with adjacent well, liable to contamination from surface washings and ground seepage. *d*, House with sewage drain to the surface. *s*, Spring in danger of contamination from drain just above. *g*, House with properly placed well and outhouse. *c*, House with cesspool, apparently properly placed on lower ground, but because of adjacent formation, the well is liable to contamination. The well at house *g* is in little danger from the cesspool because of the intervening impervious stratum of earth or rock (*i*, *i*), an impervious stratum whose relations to sanitation are important

The Danger that Lurks in a Badly Located Well.

Driven wells and dug wells reach only to ground water, differing in this respect from many springs and all deep wells. Their shallowness brings them at times into proximity to drainage from privy-vaults, cesspools or leaky drains, and anyone sinking a well near these sources of filth must rely upon the filtering action of the soil to remove pathogenic bacteria. The filtering efficiency of the soil, in serving to protect wells from contamination, depends upon such factors as the extent and the nature of the intervening soil and also upon direction of ground-water drainage. The distance that should exist between a well and a source of pollution is, because of these, so variable, that probably no definite rule would be trustworthy in all localities other than the greater the distance the better. Nevertheless, from experiments conducted by the writer for the purpose, one hundred feet was found to be the least distance compatible with safety. A less distance would doubtless be safe in certain instances, but greater risk would be incurred of encountering or establishing direct connection through cracks or passages in the subsoil. Pumping a well, moreover, lowers the water table about it, causing drainage from adjacent soil toward itself as a center. Contaminating material within the radius of this flow would thereby be drawn toward the water supply.

The course of ground-water drainage toward its natural outlet affects the liability of a well to pollution. While it usually follows the direction of the superficial slope, it may take a different route, owing to peculiar subsoil formation. Therefore, while it is better to locate a well on higher ground than a cesspool or outhouse, it is also prudent to have a safe distance intervening as an additional precaution.

Driven and dug wells, though similar underground in point of possibility of contamination, differ materially when danger of surface pollution is considered. Driven wells are comparatively secure, while dug wells, open above, or covered with loose boards, through which filth may sift, or else with low and defective curbs, invite every sort of objectionable material that may fall or wash in. For this reason, dug wells are responsible for a greater extent of typhoid infection than any other source of rural water supply.

Cisterns, if underground and near leaky drains, cesspools, and the like, are exposed to conditions similar to wells, when they are not water-tight, and few of them are. In the South, where mild winters prevail, cisterns are usually above ground and are, therefore, not subject to soil pollution. Both kinds, however, are filled by roof washings, which, if not allowed to run to waste at the beginning of a storm, may carry refuse of an undesirable though not infectious kind. Cistern water has been known to be a vehicle for typhoid, but it is not so probable a source of danger in this respect as a dug well. The care with regard to location, to entrance water, and to cleansing, should insure good water from a cistern.

Finally, it may be said that the maintenance of wholesome water supply of any kind requires constant watching. To dig a hole to water anywhere and expect good results forever afterward, is unreasonable. With the exercise of common sense, based on the knowledge of ordinary sanitary principles, a person should live in comparative security from water-borne disease.

Plants and Tobacco Smoke

PROF. MOLISCH, the plant physiologist of the University of Prague, has shown in some of his earlier work that large numbers of micro-organisms, plants as well as animals, and the seedlings of higher plants are extremely sensitive to the influence of tobacco smoke, some being even killed thereby. Many of the deleterious effects experienced by plants living in laboratories were formerly attributed to the small quantities of illuminating gas which frequently vitiates the atmosphere of such rooms, but Molisch's experiments left no room for doubt that it is really the tobacco smoke that does the harm. His pictures showing the growth of pea and vetch seedlings in the presence and in the absence of tobacco smoke are very striking.

In his more recent experiments he used older plants of various species, including species of spiderwort, *Echeveria*, *Eupatorium*, *Selaginella*, and others. None of these plants showed any ill effects from the treatment, although exposed for a long time to an atmosphere filled with tobacco smoke. Other plants, however, responded in various striking ways.

Bœhmeria utilis and *Splitgerbera biloba* changed their manner of growth. When placed in a large bell jar and a few puffs of smoke from a cigar or cigarette were blown in, the leaves of these plants, ordinarily growing at right angles to the stem, that is, in a horizontal position, began to turn on their stalks, in the course of from 24 to 48 hours, until they were in a vertical plane. In the case of the *Bœhmeria* they continued their rotations beyond this point, describing a spiral. Similar disturbances were produced upon these two plants by illuminating gas. But other plants used in the experiments showed similar effects of tobacco smoke, but did not respond to the illuminating gas.

Earlier experiments showed that various narcotics provoke abnormal development of the breathing holes on the shoot of the potato. Experiments with tobacco smoke on the potato and on other plants led to the same results, often with the accumulation of masses of liquid under the swollen areas.

In some plants of the bean family the tobacco smoke caused the leaves to drop off in a very short time. The sensitive plant (*Mimosa pudica*) and the black locust (*Robinia pseudacacia*) and others lost all or nearly all of their leaves in from 24 to 48 hours after being placed in an atmosphere containing tobacco smoke. To a smaller degree smoke from wood and paper, and illuminating gas produced similar results. The fumes of nicotine had very little influence.

Insects and Disease

The Mechanical and Biological Methods of Transmission

By W. C. Rucker, M.S., M.D., Assistant Surgeon-General, U. S. Public Health and Marine Hospital Service, Washington, D. C.

[*MAN in the Stone Age was obliged to carry on an unceasing battle for existence with ferocious mammals and venomous serpents. Happily those days have passed, but to-day the struggle to live is no less acute, but it has resolved itself into a combat with the lower forms of vegetable and animal life. Insects as the intermediary vehicles in the transmission of disease are a menace to the present and future welfare of the race, and if we would preserve our physical integrity we must live in insect-free surroundings. The field for research into this problem is a wide one, and as yet has only been touched in its most apparent phases. The future must see a combined effort on the part of the entomologist, the physician and the sanitarian if we would conquer these dangerous and annoying pests. The burden cannot be borne entirely, however, by men of science; the citizen and man of affairs must do his part in the application of the discoveries which mean so much to the individual and the race*.—EDITOR.]

The idea of the transmission of disease-producing organisms to man by insects is no new thing. For example, the Bible (Exodus 8 and 9) tells how the unusual prevalence of flies and lice was followed by a murrain of cattle and an epidemic of boils. It is only within recent years, however, that scientific workers have been able by the use of the microscope and other instruments of precision to trace the course of the seeds of disease through the body of the insect and into the body of man.

In order intelligently to approach the consideration of this latter day scientific development, it is necessary to understand the way in which the insect acquires the organisms which produce disease, the changes which these organisms undergo within the body of the insect, the way in which they are introduced into the human body, and the developmental changes which take place in them in the course of their attack upon the human victim.

Broadly speaking, there are two general methods by which this process is accomplished. These are the mechanical and biological methods. In the mechanical transmission of disease germs by insects, we find the insect in question coming accidentally in contact with disease-producing organisms and carrying them into the body of man either directly by biting, or indirectly as by infecting food. It is not necessary for the life of the germ in question that it be carried by any particular insect. No developmental changes, which are of any account, occur in the organisms during the period of this transportation to man, and therefore we may find many different insects of totally different habits acting as vectors for a given germ. As an example of the mechanical method of transmission, in contradistinction to the biological method of transmission, we have the carriage of typhoid bacilli from infected excrement by flies. In this instance the fly smears his feet, proboscis and wings with the discharges of a person who has typhoid fever, and then alighting on foodstuffs there deposits the germs to be taken by some unsuspecting person. In this instance no change whatever has been undergone by the bacilli, and they could quite as well have been carried by a cockroach which might similarly infect food. In the case of the transmission of tuberculosis by flies, the mechanical method of transmission still obtains, but it has been determined by experiments that, in this instance, there may be an actual multiplication of the tubercle bacilli within the body of the fly and that living bacilli may be discharged in the fly's excreta. In the case of the transmission of plague by the flea, another example of mechanical transmission, it is not necessary that any particular species of flea act as the vehicle. The flea becomes infected by biting an animal which has the germs of plague in its blood. The flea imbibes this pest-laden material and subsequently bites a human being. It is not by the act of biting, however, that it transmits the germs of this disease. The flea has the habit of depositing his excrement at the time of biting. A person who is bitten naturally suffers some irritation and rubs or scratches the bitten place. In doing this the germs of the disease are rubbed into the skin, which they penetrate and thus gain entrance to the body.

The transmission of malaria is a typical example of the biological transmission of a disease-producing parasite. The organism of malaria is a small unicellular animal which grows and develops in the red blood cells of man and in the various tissues of the *Anopheles* species of mosquito. This germ has two complete developmental cycles, one in the blood of man and the other in the body of the female *Anopheles*. The human cycle is the asexual cycle, development taking place without conjugation of the male and female elements. The mosquito cycle, on the contrary, is a sexual cycle, conjugation taking place. It is thus seen that for the perpetuation of this organism it is necessary that it alternate between the body of man and the body of the mosquito. *Let it be supposed that a female Anopheles* (males do not bite) bites a person in whose blood the *Hemamoebae malariae* exist. When this blood is taken into the stomach of the mosquito, the two different forms of the germ corresponding to the male and the female elements undergo a series of changes, and conjugation takes place. The result of this union penetrates the wall of the mosquito's stomach, on the exterior of which is produced a small cyst or blister. Development continues within this cyst, and many sharp spindle-shaped immature forms are taken up by the blood stream and carried to the salivary glands of the mosquito. When this mosquito bites another person it expectorates through the siphon which is used for extracting blood. It is said that the reason for this act is a desire to thin the blood which is to be extracted. As the saliva is drawn from the gland in which the immature forms are lodged it is infected with them. These bodies thus introduced into the human system enter the red blood cells, and the person becomes infected with malaria. In yellow fever, although the appearance of the causative germ is not known, thanks to the preliminary work of Finlay and Carter and the conclusive experiments of Reed and his associates, the length of the developmental cycle in man and in the *Stegomyia* mosquito is definitely known.

Flies may carry the germs of typhoid fever, cholera, dysentery and tuberculosis, and it may be that these ubiquitous household pests may carry other diseases as well. Two varieties are commonly met with in this country, the *Musca domestica* or common house fly and the stable fly or *Stomoxys calcitrans*. Both are bred in manure, and it has been recently estimated that each pair of flies surviving the winter may be the ancestors of eight million living flies during the summer. Flies are omnivorous in their habits, and will eat filth of almost any kind. The first thing to do to get rid of flies is to exclude them from the home of man, and this may be accomplished by the use of screens, both as to doors and windows. These should fit accurately and should be constructed of some permanent non-corrosive material, such as bronze wire. Inasmuch as screens are also intended to exclude mosquitoes, the screening should have a mesh of at least eighteen to the inch. After this has been done, it remains to destroy the breeding places of the flies and get rid of those things which attract them. Stables or other out-buildings should be well screened. The manure should be stored in water-tight metal lined boxes which are emptied at least once in ten days. The frequent addition of chlorinated lime or soaking with kerosene oil will also prevent breeding. Stables should be maintained in a cleanly condition. The unsanitary garbage can is the fly's paradise. The water-tight metal garbage can with a tight-fitting lid will feed no flies. If the remainder of the premises is kept clean, few of these pests will be seen therein.

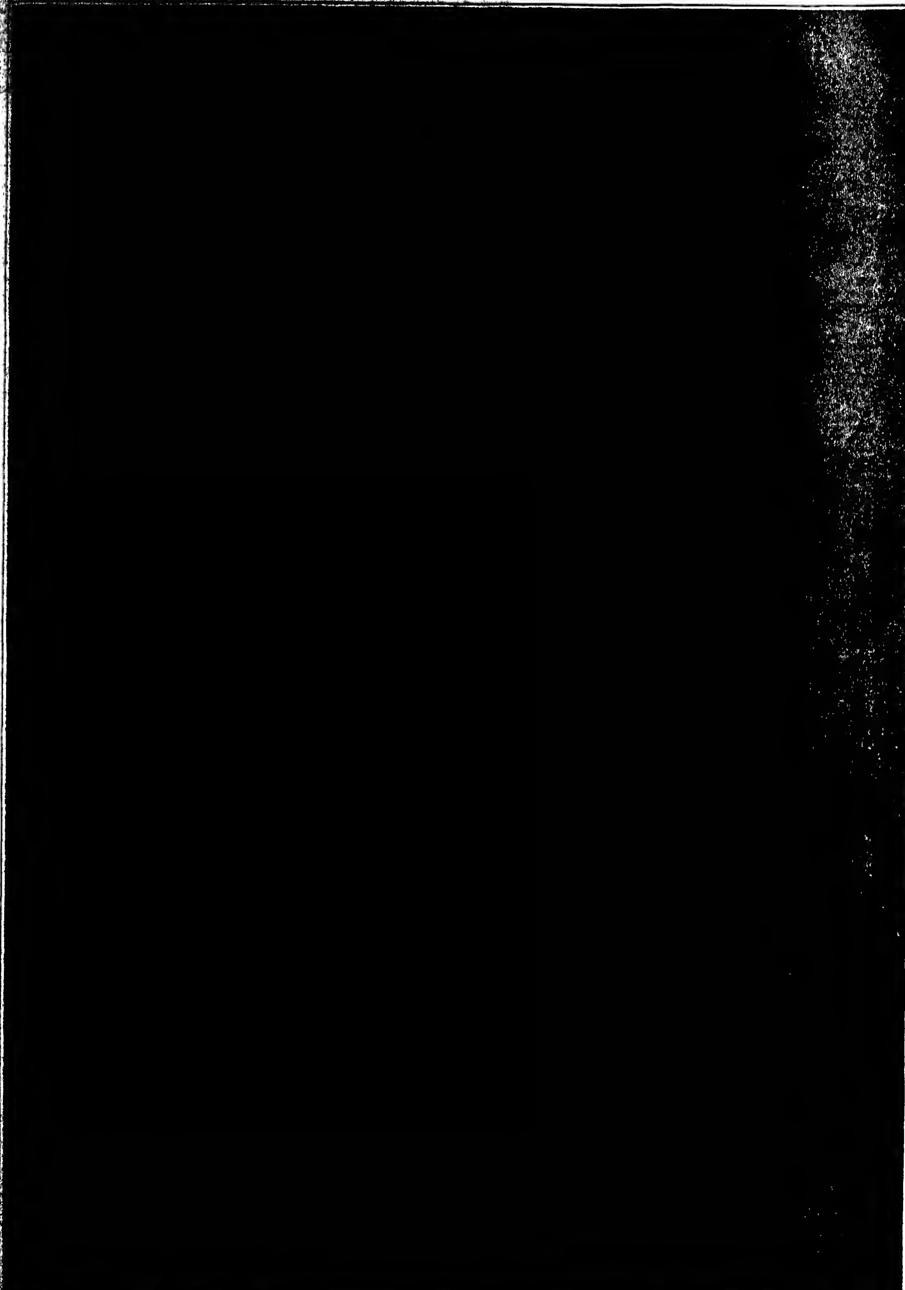
Mosquitoes of different species are known to transmit malaria, yellow fever, dengue ("break-bone fever") and filiariasis (the elephantiasis which is seen in the tropics). So far as is known, the mosquito type of transmission is biological. More than this, it is also obligatory, i. e., one general species only is concerned in the transmission of a certain disease. Since each of these species has its own particular habits, the methods to be used in destroying them should take into account these differences. In general, it may be said that mosquitoes do not travel far, and live and die on the premises on which they are bred. The yellow fever mosquito *Stegomyia calopus* is a small black and white insect breeding by preference in fresh, clean, quiet water. It is very generally distributed in a belt which extends around the world forty degrees on each side of the equator. In order that this mosquito may become infected, it is necessary that it bite a patient in the first three days of his illness. After having thus become infected, a period varying from eleven to twenty days (usually fourteen days, but depending upon the atmospheric temperature) must elapse before it may retransmit the disease. From that time to the end of its life, which is frequently as long as one hundred days, this mosquito may continue to distribute the disease among

(Concluded on page [illegible].)

Photograph by N. A. Cobb. By special permission from the National Geographic Magazine, Washington, D. C. Copyright, May, 1910.

This is a profile of a fly's head.

The large area studded with thousands of facets is one of the fly's compound eyes. A fly sees you not once but hundreds of times in all angular directions. That is why he so readily escapes your downward traveling hand. In addition to the facets he has three simple eyes at the top of his head in the middle, not visible in this picture.



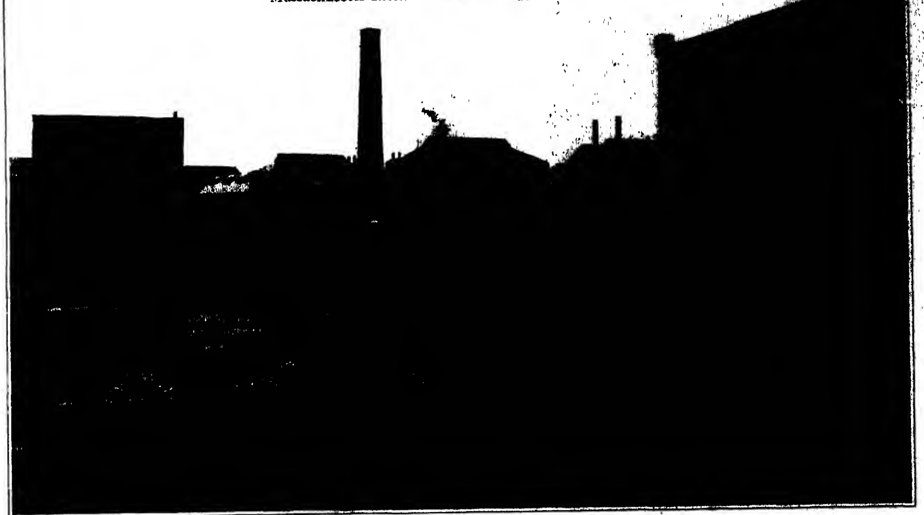
Photograph by N. A. Cobb. By special permission from the National Geographic Magazine, Washington, D. C. Copyright, May, 1910.

Your enemy the fly.

In addition to two claws, each of the six feet is supplied with two light-colored sticky pads. Germs and spores adhere to these pads and are thus carried from place to place with great rapidity, for the fly travels fast and far on its own wings, and on cars, boats and other moving vehicles. The fly cleans its feet carefully whenever they become contaminated, thus removing many of the germs that would otherwise be spread. Unfortunately the cleansing operation is not thorough enough

The Bacterial Purification of Water and Sewage

By Earle B. Phelps, Assistant Professor of Research in Chemical Biology at the Massachusetts Institute of Technology



Filter beds of the Massachusetts Institute of Technology. Three kinds of distribution of sewage to the surface are shown—the small fountain to the left, the spray to the right, and still farther to the right, the fluted cylinder of the Fidian distributor.

[*The author of this article graduated at the Massachusetts Institute of Technology in 1899, proceeding thence to the Lawrence Experiment Station of the Massachusetts Board of Health, where he remained until 1903. In that year he was appointed chemist and bacteriologist of the Massachusetts Institute of Technology in the Sanitary Research Laboratory. His official title at that seat of technical learning is Assistant Professor of Research in Chemical Biology. He was hydrographic aid of the United States Geological Survey (1905-1906) and since 1906 has been hydrographer. His special departments of research have been water and sewage purification. He is an expert in the consideration of remedies for the various evils existing in large cities. In the recent investigation of the pollution of the Hudson and East Rivers at New York, Prof. Phelps was the sanitary authority connected with the work. He devised plans for the immediate improvement of the situation. He gave Newburyport valuable advice on the subject of its clam flats, showed Providence how to improve the condition of its oyster beds and recommended means for the purification of the polluted harbor of New Bedford.*—Editor.]

Water supply and sewage disposal are pre-eminently, although not exclusively, problems of modern community life. Upon the farm or country estate, and in the small villages, nature provides fairly satisfactory solutions of both. Springs or wells, on the one hand, and privies or cesspools, on the other, properly devised and maintained with regard to the elementary rules of health and cleanliness, constitute what may be called the natural solution. With increasing concentration of population the necessities of convenience and public health demand more extensive works. Here recourse is had to what may be called artificial methods, since they call for special scientific study and engineering construction. Nevertheless, as all science is but the orderly and detailed study of nature, so the modern science of water and sewage treatment is but an elaboration and intensive application of the natural processes. To the latter then we must look for the clearest and most basic exposition of the principles underlying the bacterial purification of water and sewage.

The soil has ever been the natural and final repository for the waste products of life. Even the gaseous exhalations of animals are captured finally by plant life and ultimately become part of the carbonaceous surface of the land. The soil has a tremendous and apparently inexhaustible capacity to receive and assimilate such wastes. It has been found that if soil be heated to a killing temperature this wonderful power is lost. In short, the soil, as we know it now, is not the lifeless substance we once thought it to be, but a veritable living world teeming with invisible things, bacteria, molds, and yeasts, as well as with larger animal life, worms and grubs. It is this living soil that devours all manner of waste substances, reducing them ultimately to the simpler mineral ash from which they came. "Dust thou art, to dust returnest" could be spoken of the body no more than of the soul were it not for these great though tiny destroyers.

Let it be said now at the outset that this provision of nature is the starting point of all that follows. As the tea-kettle is to the steam turbine; as the kite and key of Franklin are to radio-telegraphy; so is the living soil to those two greatest achievements of sanitary science, the bacterial purification of water and sewage.

Nor is it wise to separate the two as is so often done. A good water supply is a prime necessity. Sewage disposal is the resulting prime duty. To bring a generous supply of water into a town without making due provision for its satisfactory removal is but a half-way measure that were in many cases better left undone. Such satisfactory removal must always involve the final disposal of the sewage in such a manner that no injury to the health, comfort, or property of the community in question or of any other one shall result.

With these few basic facts set forth, attention may now be directed to the methods by which natural forces have been directed and utilized in water and sewage purification. To further emphasize the importance of the disposal end of the system, and because it best illustrates the principles involved, let it be first discussed.

Sewage Disposal.

The earliest method of disposing of human waste was by burial, and to-day no better method exists. The introduction of water supplies led to the water carriage system of waste removal, by which the problem became one of community interest. Removal is not disposal. It serves but to shift the responsibility from the individual to the central authority; to concentrate the effort from many small natural plants to one large artificial system.

The earliest successful effort to meet this responsibility was by "broad irrigation" or "sewage farming." As early as 1560 the sewage of Bunzlau, Prussia, was thus treated. This method consists simply in allowing the sewage to flow over large areas of cultivated land, where it is absorbed and utilized in a manner strictly analogous to the utilization of manure. At Berlin, the chief city now employing this method, over 43,000 acres of land are utilized.

The comparatively large areas of land necessary, coupled with certain objectionable features of the process, such as offensive odors and the possibility of disseminating disease by means of flies or through the crops, have caused irrigation to be viewed with less favor now than formerly. Even in those places where it is most extensively employed other methods of treatment are gradually being introduced.

From the broad irrigation field to the modern trickling filter progress has been along the line of more intensive action and consequently smaller areas. The Berlin fields provide an acre of land for every hundred people. In the next type of works to be developed the rate of treatment was increased ten-fold. This was the so-called intermittent slow sand filter which may be defined as a specially prepared irrigation field. It is distinguished from the latter in that it is either constructed upon sandy areas by the laying of underground drains, or else built up entirely of sand brought from some outside source. Crops are not as a rule raised upon sand filters, and higher rates of application of sewage are therefore possible. Sand filters of this kind can be made to purify sewage to a drinking water standard.

The use of the term filter is unfortunate. It is hard for anyone who has not especially investigated this matter to appreciate the real biological activity of such a sand bed. In the popular mind the action of straining is always most important, although in reality it amounts to little or nothing. There is, of course, a certain amount of material which will not pass into the sand, matches, paper, fiber, etc., and this has to be raked from the surface occasionally to allow free access of the air. The sewage itself, however, is absorbed and entirely purified within the sand bed, its outflow being a crystal, clear stream. The same natural process which takes place slowly in a manured field is carried out on a more intensive scale in a slow sand filter.

The results of this treatment are well nigh perfect, and no further investigations would be necessary were it not for the fact that in the neighborhood of large cities, land of suitable character and of sufficient extent is seldom available. Especially is this true in certain parts of the country where sand is uncommon. Efforts have been made to overcome both these difficulties by the construction of types of beds utilizing other materials than sand and capable of receiving sewage at much higher rates. The best known of these latter-day processes is the contact bed. This differs from the sand filter chiefly in the fact that crushed stone is employed for a filter medium. In this again we are dealing with biological oxidation of the sewage, an action due to the numerous minute organisms inhabiting the filter. Contact beds need breathing periods during which they

are filled with air, but with these included they are capable of treating sewage at a rate fully ten-fold that of the sand filter. Such a contact bed tends to accumulate material to a certain point, after which it reaches a condition of approximate equilibrium, dissolving and oxidizing the stored material at nearly the same rate at which that material is applied. Curiously enough, the accumulated material within such a bed when removed is found to be quite inoffensive in character and to resemble very closely a rich garden loam.

The latest and most important development in oxidizing filters is represented in the trickling filter. In construction this is similar to the contact bed except that it is deeper; as in the sand filter, the sewage passes continuously through the bed. The greater depth provides sufficient detention of the sewage and the better facilities for the entrance of air into the body of the filter make the oxidizing process more rapid. The trickling filter can treat sewage at rates two or three times those that are possible in the contact filter, so that as a result of 25 years' study the sewage of 25,000 inhabitants can now be disposed of upon one acre of land, whereas in the old irrigation fields one hundred persons was the safe maximum for the same area. This improvement in rate has not been secured without some sacrifice. It is not practicable to secure the perfect results of the sand filter in the rapid processes necessary for large communities. With the increasing rate there has been a decrease in the quality of the purification, especially as regards bacteria. The primary function of purification, oxidation of the organic matter, is performed satisfactorily, so that for the protection of streams and larger bodies of water these methods would suffice. But the effluents or outflows are not clear and attractive and the bacteria have not been satisfactorily removed. From a public health point of view, therefore, much is still desired in sewage purification. Fortunately, the investigator in sanitary science has been equal to the occasion, and means of chemical disinfection have recently been developed which effectively supplement the work of these most efficient oxidizing methods. But chemical disinfection is not strictly a bacterial purification and lies aside from the immediate purpose of this discussion.

The septic tank and its many modern modifications are important in a consideration of sewage purification. These are the offspring of the old-fashioned cesspool, but the modern development is as far removed from the original device as is the trickling filter from the irrigation field. In a septic tank the biological action is very different in character from that which we have considered. Instead of oxidation with an abundant supply of air always present, we find here an anaerobic condition, that is a working without oxygen, and chemical reduction. The natural effect of this action is the rapid solution of solids along with certain other chemical changes, and the liquid thus treated can be discharged upon filter beds of the various types described at even higher rates than would be possible with untreated sewage. Thus, the septic tank and its modern successors, the biolytic tank, the Imhoff tank and all the others, are preparatory treatments only.

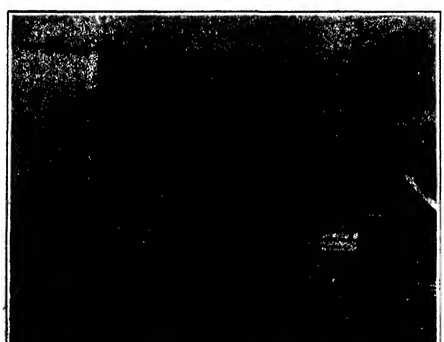
Water Purification.

Just as we have seen how the science of sewage purification employs those very principles by which the soil in nature brings about the ultimate destruction of organic matter, so in the field of water purification we again look to nature for our methods. Despite the obvious fact that the earth is the final repository of all things that have ever lived, both animal and vegetable, and that its surface is literally covered with organic material in the process of return to the mineral world, yet waters issuing from the ground have ever been regarded as the very emblem of purity. Closer investigation shows that this popular belief is well founded. No purer waters are to be found in nature than those which have passed through a considerable body of the earth, save in the single instance of newly fallen rain. One frequently finds pure crystal water issuing from a spring whose obvious source is some nearby, stagnant pool, filled with all manner of animal and vegetable matter, living or in various stages of decomposition. Between the two, therefore, there must be some ample purifying agency. This agency is found to be once more the living earth which has been so frequently referred to. If, now, these natural resources can be developed and intensified so that they may be utilized in artificial structures for the purification of water, the problem of a pure water supply will have been solved. This is exactly what has been accomplished.

Artificial beds of sand only a few feet in depth, carefully prepared with under-drains and properly operated to secure the maximum efficiency, constitute the sand filters upon which so much reliance is now placed in the purification of city water supplies. Within these beds the bacteria find lodgment and increase enormously in numbers. The organic matter contained in the water, constituting its impurity, is seized upon by these small organisms and is transformed by them into harmless mineral residue. Rates of filtration are so rapid that in most cases there is also, incidentally, surface accumulation of debris composed of solid impurities in the water. This straining action is oftentimes regarded as an important factor in the work of these filters. To a certain extent this view is correct, but mere straining action would bring about little purification. The all-important item is the bacterial life within the bed of the filter. When this becomes incapacitated by low temperatures or by other unfavorable conditions, the efficiency of the filter diminishes at once. When conditions are most favorable for biological activity, efficiencies are at their highest. A simple calculation will show that the size of the sand grains is to that of the bacteria about as the size of an apple to that of a bird-shot, and illustrates how futile would be any attempt to strain out bacteria from a polluted water by mere passage through sand. How much more impossible would be the removal by straining of dissolved coloring matter, the dimensions of which are molecular. Yet both bacteria and coloring matter are removed in a well regulated sand filter.

Winter difficulties of a filter.

The sprinkling filter and sand beds at Burlington, New Jersey.



The Fidian distributor, which appears in the head-piece of this article, but revealed more in detail.

The so-called "mechanical filter," developed largely in this country, is a very different mechanism. It operates at a rate about fifty times as great as the permissible sand filter rate and is purely mechanical in its action. For this purpose sand is also employed, although a coarser grade is preferred. Before passing through the sand, the water must first be treated with a suitable coagulant, alum being commonly employed. The alum enters into a mechanical combination with certain natural constituents in the water, gathering together all fine particles of suspended impurities and to a large extent absorbing dissolved impurities, such as color and odor producing substances. After the water has been coagulated in this way, it is allowed to settle, and is passed finally through these rapid coarse sand filters at a high rate. The filters strain out the remaining alum precipitate and the result is clear water quite free from bacteria and other impurities. This process is not truly bacterial purification, but it occupies an important position in American practice. The early objection to the use of alum in the water has practically disappeared. It has been learned that under proper management it is impossible for any alum or any resulting compound to pass the filter and reach the consumer.

These two types of water filtration have quite distinct, although at times overlapping fields of usefulness. The slow sand filter is especially adapted to the purification of sewage polluted waters where the removal of disease-producing bacteria is the object sought. In this field they seem to be distinctly superior to the mechanical filters. The latter are of especial value and even indispensable with waters that are highly colored or that carry clay or mud in suspension.

The most recent development in water purification, and one which has come into very general use within the past few years, is the so-called "hypochlorite treatment." This also is a purely chemical treatment and may be used either by itself or in conjunction with some filtration process. Its sole object is the destruction of disease-producing bacteria. Clear, colorless waters that are only slightly polluted lend themselves admirably to this treatment without filtration. Waters which have undesirable physical characters, color or muddiness are not improved thereby. As an adjunct to mechanical filtration, which, as has been stated, is not alone best able to deal with bacterial pollution, this process is most valuable. Its great economy and its simplicity of operation and excellent efficiency commend it highly. Its value is indicated by the fact that although it has been in use but a few years, it is now employed regularly by most of the large cities of the United States and Canada and by many hundreds of the smaller communities. There is a similar objection raised against this process to that which was raised in the case of alum, but this is bound to be short-lived. The time is fast disappearing when people are going to let weak, sentimental ideas of so-called purity stand in the way of real sanitary and economic progress. Man is frequently able to improve upon nature's work. Pure water is an ideal, but as between purified and unpurified water, even though the former involves the application of a disinfectant, the common sense of the community will not long hesitate. However we may reverence the ideal of purity, we will not take long to choose between disinfectants of well-proven harmlessness on the one hand and typhoid fever germs on the other.

The Problems of a Country Estate.

Thus far we have discussed water and sewage purification for large communities. It is here that the problems are most intense and that their successful solution means most for the welfare of the people.

(Continued on page 45.)

Sewage and the Farmer

A Problem in the Conservation of Waste

By W. T. Sedgwick, Sc.D., Professor of Biology and Public Health and Director of the Sanitary Research Laboratories and Sewage Equipment Station, Massachusetts Institute of Technology, Boston

[*PROF WILLIAM T SEDGWICK needs no introduction to those conversant with the story of public health education and its movements in the United States. Born at West Hartford, Conn., he graduated from the Sheffield Scientific School, Yale University, in 1877, with the degree, Ph.B., gaining Ph.D. at Johns Hopkins in 1881 and receiving Hon.Sc.D. from his alma mater in 1909 He was instructor of physiological chemistry at the Sheffield School in 1877 to 1879; fellow and assistant biologist at Johns Hopkins in the latter year, coming to the Massachusetts Institute of Technology in 1883. Here, from assistant professor, he has risen to Professor of Biology and Public Health and Director of the Sanitary Research Laboratory He is the man who established at the Institute more than twenty-five years ago the courses in biology, later developed into public health work. So successful have they been that the graduates are directing large sanitary works in many parts of the country Wherever there is an important question of pollution of water supply, or the discussion of conditions inducing infectious disease, he is certain to be consulted He was one of the experts named by Pittsburgh to investigate the typhoid outbreaks in that city. He and his graduates, Winslow and Whipple, constitute the non-medical portion of the New York Typhoid Fever Commission*

In an age when popular enthusiasm is seizing on fragments of scientific truth and magnifying them till they overshadow and obscure the fundamental and important facts, he has opposed the present craze for "swatting the fly," which at best is only warring on a symptom and neglecting the disease, or destroying the danger signal, while yet the danger exists. In these later years Prof. Sedgwick has stood sturdily for conservation. He is opposed to the wholesale destruction of foods because they are merely of inferior quality, and believes that Government supervision should preserve and make safe such products This has brought him into disagreement with some of the Government methods. His present article is in the line of conservation of sewage, which is everywhere turned to waste, but which has in it valuable elements for some of the industrial or agricultural processes. --EDITOR]

The farmer is always seeking for fertilizer for his fields and crops It seems therefore at first sight as if the sewage of our towns and cities ought all to be carefully collected and turned back upon the farms that feed them The farm feeds the city, why should not the city, plus air and sunlight, feed the farm? The idea is very old, yet it seems forever new. Chemistry confirms and enforces it, for nitrogen—that wonderful element, which, in its virgin state, seems so indifferent, so inactive, but in its compounds so full of energy and so much alive—nitrogen flows alike from sea and land, from fisheries and from farms into those living whirlpools which we call cities, there to revolve for a time and finally to be expelled, largely as sewage, in new chemical combinations, lower and less potent in the scale of energy, but still highly favorable as food stuffs for low plants and animals.

Some such reciprocation between city and country there actually is The manure of city horse stables is carefully saved and sent back to the farm. Garbage is not infrequently likewise saved and sent back to piggeries in the suburbs The carbonic acid gas given off by human beings, animals, plants and by the great fires and furnaces of cities mingles with the atmosphere and helps to maintain that mighty reservoir of carbonic acid upon which the green plants of sea and land draw for their raw materials for manufacturing starch and sugar and cellulose—three of the most important elements of human life and industry.

How We Waste Nitrogen.

But water and the nitrogenous wastes of cities are not often thus returned—at least not directly More often they are emptied as sewage into rivers or harbors or the sea, to mingle there with larger bodies of water, which latter material returns to the farmer only after evaporation or distillation into the atmosphere and condensation as rain or snow or hail or fog or dew.

As for the nitrogen of the sewage, this comes back but slowly, if at all, and chiefly in fish, shellfish, seaweed, and other familiar products of the sea, so that there is nowadays a steady and a heavy drain of nitrogen away from the land and into rivers and the sea. The same thing is true of phosphate, and probably to a greater or less extent of the other elementary substances underlying plant and animal life. In short, there is to-day a constant sapping of certain indispensable elements of the food of plants and animals from the land to the sea, and only a limited return of these same elements from sea to land. To some extent this drain upon the resources of the land, and that means of the farmer, goes on even in an uninhabited region, for the ground waters which go to feed the streams, and which in dry times make up a very large part of many streams, always carry more or less nitrogen.

So, too, there escapes, even from a sewerless city, and from a region where the excreta of human beings are carefully collected and used in agriculture, through the ground water which comes from such regions, much nitrogen in the form of nitrates.

But undoubtedly the heaviest loss, the greatest drain, comes with the sewerage of cities and towns, and the quick discharge of solid streams of sewage directly into rivers or the sea without any previous contact with the earth which, like a mighty sponge, would hold the sewage for a time and give opportunity for chemical changes followed by absorption and assimilation by plant life. Under this, the modern, system the draining of nitrogen and phosphates away from the land is rapid and continuous; and it is no wonder that great scientists like Sir William Ramsay are giving to the subjects of "nitrogen exhaustion" and "nitrogen supply" anxious consideration.

The Farmers' Interest in the Sewage Question.

But if the sea is just now the gainer and a kind of nitrogen accumulator, ought not the fish to benefit and multiply exceedingly? And, on the other hand, if all sewage should be used in agriculture and our fishing continue or increase, would not the sea soon be depleted of nitrogen, and the fisheries disappear? This is an interesting question, but one which we need not try to answer here. What we are trying to do is to learn what is the farmer's interest in the sewage question, and that means: How can the farmer best secure the return to his lands of the nitrogen and phosphates which he sends to the city but which the city after using fails to return to him?

The easiest answer is that he should have the liquid wastes of the city at his disposal as he already has the atmospheric wastes and (sometimes) the garbage and the stable manure of cities. In other words, that the sewage streams of cities should be poured, not into rivers or the sea but upon the land, where their precious elements would not be lost or wasted but made over by plants into food for man and beast. This is the simple ideal solution of the sewage-conservation problem and of the prospective difficulties of the farmer.

The Effect on Fish of Withholding Sewage.

But it should be noted in passing, that this plan, perfectly carried out, would very likely seriously deplete or at least damage our fisheries, since fish life is rich in nitrogen and the amount of nitrogen in the sea, though immense, is not unlimited. Moreover, the theoretical way out is beset with many practical difficulties. The worst of these is the seasonal and climatic difficulty. Sewage is a constant, daily product of urban life, and must be disposed of daily and even hourly, rain or shine, in summer and winter, in wet weather as well as dry. But the needs of plant life are not thus constant or perennial, but highly variable, according to season, climate, temperature, rainfall and many other conditions. There is thus this difficulty: If sewage is to be disposed of satisfactorily to the community which has it to get rid of, it must be taken away by river, sea or farmer completely and uninterruptedly; by night and day, summer and winter, rain or shine.

This requirement is easily met by rivers or lakes or the sea, but not by the farmer, at least in regions of marked seasonal variation and considerable rainfall, for at times his crops, simply cannot and will not absorb any additional liquid, however nutritious. Hence the sewage at such times must flow off unpurified and liable to create a nuisance, while the crops suffer from excess of water. In the arid or the semi-arid regions the farmer may perhaps at all times and all seasons welcome the arrival of the sewage stream upon his land, for irrigation with sewage ought to be the best and most successful form of irrigation in such regions.

It is certainly a significant fact that very few, if any, successful sewage farms exist to-day in the eastern part of the United States. The subject of sewage disposal has now been agitated in America for about twenty years and during these years the problems of extended and improved agriculture have been studied as never before in this country by the U. S. Department of Agriculture and by the Agricultural Colleges and Experiment Stations of the several States; and yet it remains true that there is not one important example of extensive and successful sewage farming in the populous and urban Eastern United States. On the contrary, New York, Boston, Philadelphia, Baltimore, Washington, and many lesser seaboard cities pour their sewage into the sea, while Chicago, Cleveland, Milwaukee, St. Louis, St. Paul, Minneapolis, Cincinnati, Louisville, and many minor cities of the interior empty their sewage into rivers or lakes connected with the sea, so that the farmers nowhere recover from these cities the elements which they contribute to them.

The reason for this common practice is plain. It is easier and cheaper to secure quick, convenient and constant disposal of the huge volumes of sewage which our cities must get rid of, by the means actually adopted than by disposal upon land. And yet, if the sewage of Boston could be carried to Cape Cod, or that of New York to the sands of Long Island, Philadelphia's to the Pine Barrens of New Jersey, or that of Baltimore to the sometimes poor and thirsty soil of the Eastern Shore of Maryland, then might these comparatively desert places be made to blossom like the rose. But even so the fish of the sea would suffer, the gardens of the ocean being robbed to feed those of the land. Perhaps we have here only one phase of a world-old dilemma: the land rising solid from the sea only to be dissolved in rain and carried back to it in aqueous solution; the elements then picked out from the solution by plant and animal life, thoroughly deposited in shells or skeletons, and at death added together to make once more the solid earth.

It may be that if we do not use our sewage upon the land we shall by and by be driven to seek our food more and more within the sea. The Japanese and the Chinese eat not only fish but seaweeds, and it would be strange indeed if Americans likewise should give up the land vegetables of to-day for the sea weeds of to-morrow.

Objections to the Farm Use of Sewage.

From the sanitary point of view the utilization of sewage in farming is open to some serious objections. In the first place, the mere fact that sewage is brought to the farm at all, means that disease germs and parasites may come with it to places and persons previously free from access to a contact with these undesirables. In the second place, owing to the difficulty of escaping contact with it, farm hands, and through them their families, will be especially exposed to personal infection and in some cases to air pollution also. In the third place, certain products of the farm, and especially vegetables such as celery, radishes, turnips, beets and beet tops, spinach, water cress, lettuce, potatoes and onions; and certain berries or other things grown upon or near the earth, such as strawberries and peanuts, which are either eaten unwashed or "handled" preparatory to cooking; if they are irrigated with sewage or are grown on soils recently flooded with sewage, may become soiled with particles of excrement and infected with dangerous microbes or other parasites.

It must be confessed, however, that the experience of Berlin, the capital of the German empire, where the sewage of upward of two millions of people is disposed of upon sewage farms, seems to show that this danger is more theoretical than actual; for the death rate of Berlin from typhoid fever is one of the lowest among the great cities of the world, and the experience of Berlin in this respect is confirmed by that of many smaller cities in England and elsewhere. If it be asked why it is that Berlin, almost alone of all the greater cities of the world, has adopted sewage farming as its means of sewage disposal, the answer is that owing to its inland situation Berlin was compelled to devise some other means than sea disposal, and having only a small stream in its vicinity, was obliged to resort to some form of disposal upon land, i. e., either to intermittent filtration or to broad irrigation (sewage farming). The former is land disposal without reference to the giving of crops, the latter land disposal combined with agriculture or horticulture.

The conclusion of the whole matter is that, except in the more arid portions of the United States, the utilization of sewage in farming does not seem likely to increase at present. Consequently, we may have to look in the future for our supplies of food more to the sea and less to the land.

Curiosities of Science and Invention

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.

The Licensed Sand Sculptor

THE sand sculptor, familiar to visitors to the sea shore, has advanced from a small beginning and a somewhat checkered career to the dignity of a regularly recognized artist. At first the efforts of this picture maker were crude in the extreme. Fashioned from real sand the figures he produced were scarcely worthy of serious notice, either as art productions or as a bid for the coins of the beneficent. It was almost impossible to work with sand alone, and as the productions were as unsubstantial as the snow figures of the winter season, no one was interested in the "artist's" work to the extent of more than a glance in passing on the boardwalk at one of the seaside resorts.

But in this country no one is satisfied for long with crudities. While sand artists abroad continued to work in sand alone, the American "sculptor" experimented with various materials until he had found something that would pass as sand but which was almost as substantial as hardened clay. As soon as the improvements began to be evident and the public began to take serious notice of the sand artist and his work it became a profitable business and the sands along the boardwalk began to swarm with "artists." Many were quite ignorant of art, but contrived to fashion a few figures that a good-natured public recognized as well intended, and rewarded with small coins. Some were genuine artists seeking in this way to pay for a summer vacation, or students trying to earn enough in the summer to weather the financial storms of the winter. These of course were annoyed by the ridicule brought on the business by the unskilled ones and encounters took place between rivals that at last compelled the authorities to take notice of the presence of the sand artist colony and take steps to regulate the business in some way.

Atlantic City was the first sea shore resort to insist on a license being first obtained before any one could stake out a claim on the sands and start business as a sand sculptor. There was appointed a committee to examine the work of the various artists and pass on its merits. The decree went forth that all work that could not pass muster with the committee as possessing some sort of art merit should be demolished and the artist driven from the beach. Some of the workers had been unwise enough to stoop to vulgarity in their creations and this hastened the work of the committee. The long line of sand sculpture exhibits that stretched along the front of the boardwalk was inspected closely and the committeemen retired to compare notes and report. Next day a band of large-footed policemen marched down the line and whenever they reached a sand sculptor's exhibit that had come under the ban they proceeded to stamp it to pieces, with a warning to the "artist" to come there no more. As a result of this proceeding the exhibits that will be seen this summer are only those that are really attractive and have some claim to being artistic.

The figures are made of sand and cement mixed, to give the finished work the hardness of mortar. One of the best sand artists, the leader of the colony at Atlantic City, originated the exhibit of classic figures shown in one of the photographs. He was the first to construct his sand display on a slanting base so that the exhibit faced the board walk at an angle suitable for observation and he also gave the figures a coat of white paint which brought them out in bold relief against the dark sand. It was not long before others imitated the classic artist and even improved upon his idea. Subjects were selected that lent themselves to original coloring and with fine disregard for historical correctness the sculptors adorned George Washington, standing in the boat of sand in the act of crossing the Delaware, with a bright red coat and provided his sailors with blue shirts and his attendants with sartorial accessories of any hue that harmonized with the general color scheme.

An 80,000 candle power searchlight for a transatlantic liner.

A clever bit of work done in sand and cement.

General view of the classic figure exhibit.

"Empty" gasoline barrel exploded by the sun's heat.

First Searchlight for Transatlantic Liners

THE most powerful searchlight ever carried on a merchant ship was a conspicuous feature of the "Kaiserin Auguste Victoria," which arrived in New York recently. The great light, which is the largest type ever constructed, is designed for the steamship "Imperator." It is being carried across the Atlantic to be thoroughly tested at sea and on entering harbors. It throws a beam of light of 80,000 candle power. On approaching port, the searchlight was turned on the Scotland Lightship, rendering the name of the ship clearly visible at a distance of several miles. The great light is effective for seven miles at sea, and when thrown upon the clouds is clearly visible for a distance of thirty miles.

The searchlight reached the vessel only three hours before her sailing and was carried on the forward deck. It will be installed on the lookout, high up on the mainmast, where it can be swung quickly to any angle. The searchlight is of the type used heretofore only on the largest dreadnought battleships. The lens is 42 inches in diameter. It is operated by a current of 13,000 watts on a 110-volt circuit. In actual tests at sea, the ray has pierced fogs and distinguished distant objects at every point of the horizon.

Precautions With Empty Gasoline Barrels

THAT gasoline is dangerous is pretty generally understood, though the death toll from careless handling is heavy. Usually familiarity with any dangerous thing breeds contempt, but even down in the "oil country" gasoline is treated with a respect that is greater than that given to nitroglycerine.

Many persons have always had the wrong idea regarding the dangers from gasoline. They have taken the greatest precautions with the full barrels and have given scant attention to the partially filled and empty ones, in fact, very few dealers and users have ever given any thought to the care of empty gasoline barrels. That this is wrong is shown by the accompanying photo of an exploded "empty" gasoline barrel. This barrel "went up" while standing in the hot sun on the platform of the freight station. It is a 50-gallon barrel made of heavy iron. The heads are of a single sheet, slightly crowned and set on a projection rolled on the inside of the cylindrical barrel sheet. A solid welded ring is placed against and around the head and the end of the sheet is rolled over the ring and tightly crimped. In the exploded barrel the head was bulged like a grocer's scoop, the ring torn apart and the crimp of the barrel sheet pulled out straight. This explosion made a very loud report and the pieces were blown to a great distance. Fortunately, no one was injured, though some damage was done to other equipment about the barrel. By "empty" gasoline barrels is meant those that have been unloaded by dealers or garages, both public and private. They are the barrels rolled out to be returned to the refineries for refilling. These barrels are a source of danger and should receive greater care. The cause of the explosions of these barrels is the excessive pressure of the gasoline vapor generated when standing in the hot sun. A little oil is liable to be left in them and if the vent plugs are screwed in tightly there is danger of an explosion. Drain the barrels thoroughly and have the vents opened; also store the barrels in a cool or shady place.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Stagmatypy: A New Half-Tone Printing Process

If a solution of gelatine is cautiously mixed with one of gum arabic the two do not coalesce into a single homogeneous solution, but form an emulsion composed of minute drops of gum suspended in the solution of gelatine. If a glass plate is coated with this emulsion an irregular vibratory movement of the gum globules, of the character of the Brownian molecular motion, may be detected with the naked eye, while observation with a microscope shows that the minute globules gradually agglomerate into larger, though still very small spheres, which finally come to rest at approximately equal distances from one another. The configuration can be fixed by carefully drying the plate.

A plate of copper or zinc coated in this manner with a gum-gelatine emulsion which has been made sensitive to light by the addition of potassium bichromate, forms the starting point in a new and remarkable half-tone printing process which Dr. Hans Strecker has devised, and named stagmatypy, from the Greek word *stagma*, a point.

In all methods of reproducing, by the printing press, photographs or other pictures having a continuous gradation of light and shade, the various tints, technically called "half tones," are represented by lines or dots separated by white spaces. All of these lines or dots are necessarily of the same color—that of the ink used in printing—but they vary in width according to the depth of tint, so that every gradation of the original picture, from black to white, is represented by the proportion of black lines or dots to white spaces in the corresponding part of the reproduction, as in a highly elaborated pen-and-ink drawing. This principle applies to all varieties of printing plates, including relief plates in which the raised portions alone take ink from the roller, as in wood-cut printing, etched plates in which the ink is wiped off the general surface but not from the depressions, and lithographic plates, which take the oily ink only at parts prepared for printing by previous applications of such ink.

The disintegration of the half-tones into separate lines or dots is usually accomplished by photographing the original picture through a fine grating of parallel lines or network of intersecting lines, photographed on glass. The result is a mechanical, lifeless print which often fails signally to reproduce the individuality of the original. The actual pattern of the grating, fortunately, is apt to escape the notice of the superficial observer, but it appears conspicuously under a magnifying lens and is often apparent to the naked eye. A person who has seen it in one picture is tempted to look for it and find it in others, and then his eye involuntarily follows the straight lines of dots, and the artistic effect is spoiled.

Several processes have been devised for making the "grain" of the picture less regular, but none of them have achieved complete and lasting success. In some of these processes the picture is photographed through a stippled or dotted screen, while in others no screen or grating is employed, but the "grain" of the half-tone print is produced by particles of asphalt applied to the metal printing plate in the form of dust, and then fused, before the sensitive film is applied. In the heliogravure process, for example, the polished copper plate is first dusted with asphalt in a special apparatus, and a second operation is required to melt the dust and attach it to the plate. A photographic copy of the picture is made on paper coated with bichromated gelatine and the undeveloped print is applied, face downward, to the asphalted copper plate. The paper is then washed off, and the gelatine film, which remains attached to the plate, is developed into a picture in relief by the action of hot water. This process, which is common to all half-tone printing methods, is based on the property of bichromated gelatine to swell in hot water to a degree inversely proportional to its exposure to light. After all of these operations the plate is etched by immersion in a bath of ferric chloride.

Even the ordinary half-tone process is tedious and laborious in comparison with stagmatypy, and the glass gratings employed are costly and fragile.

This half-tone was printed from a Stagmatype plate

The new stagmatype process is remarkably simple. The granulation required to reproduce the half-tones is effected automatically by the agglomeration and precipitation of the gum globules when the bichromated gum-gelatine emulsion is poured on the metal plate, forming a grain of approximately but not entirely regular pattern which, when dried, resists the action of the etching fluid very well. The plate is then exposed under an ordinary negative and immediately etched without having undergone the separate operation of development followed by drying and varnishing, which the ordinary half-tone processes require. The four distinct operations employed in heliogravure, namely, the formation of the grain, the coating of the plate with the sensitized or exposed film, development and etching, are replaced by two operations in stagmatypy. The grain is formed automatically during the coating of the plate, and development and etching are effected simultaneously by immersing the plate in a solution of ferric chloride, the water of which produces the development while the iron salt, diffusing through the film, etches the metal in exact correspondence with the progress of development.

This remarkable simplicity makes stagmatypy much cheaper, as well as more expeditious, than heliogravure or the ordinary grating method, both of which it may replace with advantage. The only conceivable additional amplification would be to make the original photograph directly on the printing plate, and even this may prove to be practicable.

Another example of Printing by Stagmatypy

Another advantage of stagmatypy over the ordinary half-tone process is the greater richness of detail obtained in the print. It is obvious that a photograph made through a grating or net cannot reproduce every point of the original. A continuous black line, for example, is necessarily represented by a broken line. In stagmatypy, on the contrary, the unaltered negative is laid directly on the printing plate, the grain of which is formed automatically according to the character of the picture, so that the reproduction of a black line is as continuous as the original. For the same reason, the stagmatype reproduction shows a great superiority in contrast and depth of shadows—qualities in which the ordinary half-tone print is sadly deficient.

In order to obtain fairly satisfactory results by the usual half-tone methods it is necessary to use very finely ruled screens and the best grade of printing paper, and to employ great care and skill in all of the operations. This is not commercially practicable for ordinary work, in which coarser screens are employed, with inferior results. In this respect, also, stagmatypy presents an advantage, for a coarseness of grain that would be intolerable in an ordinary process print is barely perceptible in a stagmatype print, where the grain is not arranged in straight lines and set figures. On the other hand, the automatic stagmatype process can be made to furnish a much finer grain than can be obtained from ruled screens. Stagmatypy, therefore, may be applied to all grades of paper and subject, from the finest art reproductions to newspaper illustrations.

The new process is particularly advantageous in color printing, because it cannot produce the *moiré* effect which is often caused by inaccurate adjustment of the regular patterns of the several colors in the ordinary process. In stagmatypy the colors are automatically blended, and their proportions can be regulated in a novel manner by varying the size of grain for the different tints.

The most important application of stagmatypy appears to be to lithography, both monochrome and polychrome. By printing the stone with a stagmatype plate etched in intaglio a wonderful softness of effects is produced, as only the fine interstices of the granulation are impressed on the stone. Another interesting application is to the direct reproduction of drawings in pencil, charcoal, crayon or India ink without the intervention of the camera. The drawing, executed on a sheet of gelatine or similar transparent material, is laid on the sensitized stagmatype plate in a photographic printing frame, and the plate, after exposure, is simultaneously developed and etched, in the manner described above. In lithographic copies made in this way the character of the medium, pencil, crayon, etc., is reproduced with wonderful fidelity.

For etching the stagmatype plates Dr. Strecker has devised an electrolytic method which greatly facilitates the operation. The plate, suspended in the ferric chloride solution, forms the anode. An amperemeter, included in the circuit, indicates the moment at which the action begins and the rapidity with which it progresses. Hence, the etcher is not compelled, as he is in the useful chemical method, to follow the progress of the action on the plate itself with the greatest care, in order to replace the strong etching bath by a weaker one at the right moment. He can, therefore, conduct the etching of a number of plates at the same time. The electrolytic etching process can be applied to zinc, brass or steel, as well as to copper.

Stagmatype plates retain their sensitiveness

[illegible] copper plates [illegible] zinc plates for more [illegible]. Hence they are likely to become articles of commerce, like ordinary dry plates.

The Trade-mark as a Business Asset

By W. E. Woodward—I

[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the first of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analysis of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

If you should find in your Santa Claus stocking, next Christmas, a gift of the exclusive right to use the word "Royal" as a name for baking powder, you would be $8,000,000 richer than you were the day before. It is said, on good authority, that the Royal Baking Powder Company considers its trade-mark worth just $1,600,000 a letter. This is, perhaps, the most valuable trade-mark in existence, though it is rivaled in value by "Kodak," "Uneeda," "Ivory" (as applied to soap), "Coca-Cola," the name "Gillette," used in connection with safety razors, and a half-dozen others. Each of these trade-marks has become a national institution. To displace them in the public mind would require competition of unheard of magnitude and energy. The name "Coca-Cola" is worth at least $5,000,000; the Gorham silverware mark, $2,000,000, at a fair estimate; the trade-marks of the National Biscuit Company, all of which touch the highest standard of distinctiveness, must be the largest asset of that concern; and the name "Kodak"—where would the Eastman Company's business go to if it should hand over the trade-mark "Kodak" to some other concern, and go on making the same goods under the name of Smith's Hand Cameras? When the American Tobacco Company was recently dissolved into separate concerns, under the order of the Supreme Court, the trade-marks of the combination were estimated to have a value of $45,000,000, out of total assets of $227,000,000.

The aggregate total value of well-known American trade-marks must be in the hundreds of millions of dollars. But any estimate of the value of a trade-mark, apart from the business to which it applies, is necessarily a mere guess, for a trade-mark is a species of commercial property that cannot be sold by itself. It is inseparably attached to the business from which it emanates, and cannot be transferred without a transfer of the business. There are cases where a concern's trade-mark has become so valuable, through long years of popularity and profit-making, that it entirely overshadows all other assets of the business—in short, the business could not exist without it. A trade-mark is a symbol of good-will—using "good-will" in the same sense that the bookkeeper uses it. It stands for built-up reputation; it is the link that connects the ultimate consumer with the manufacturer. It preserves the identity of merchandise, and, in carrying out this function, it is a device of inestimable value to the commercial world.

Sometimes a complex chain of events is best explained by a simple illustration. With this idea in mind, let us put ourselves in the place of a woman who wants a cake of Ivory soap. She lives in a desert town in Arizona. She cannot go half across the continent to Cincinnati to buy a five-cent cake of soap from the makers. In fact, it is a safe bet that she never heard of the makers, but she knows that she wants Ivory soap. So she sends her little girl down to the "general" store, and this lisping messenger asks for "Ivory" soap—not just plain "soap"—and brings the familiar package with the name on it back to her mother. If the storekeeper sends some other kind of soap the owner of the nickel knows instantly that she did not get what she wanted.

By means of the trade-mark "Ivory" the manufacturers in Cincinnati deal with this buyer in Arizona as surely and as expeditiously as if she lived across the street from their factory. Trace this transaction backward, and you will find its trail running unerringly through the retailer, the wholesaler, and the jobber to the manufacturer—and at every stage of its journey the product kept its personality. It left Cincinnati as Ivory soap, and as Ivory soap it was put into the consumer's hands.

Selling by trade-mark is one of the miracles of modern merchandising. Its development to a state of high efficiency has taken place during the last hundred years.

The early decades of the nineteenth century witnessed the rise of three great forces which were destined to accomplish, in a short time, the most profound changes in manufacturing and selling methods. These forces were:

1. The application of steam power to manufacturing in a large and economical way.

2. The development of cheap and quick transportation.

3. The invention of means for the rapid dissemination of intelligence.

Factories employing thousands of hands—great industrial monuments to cheap power—had inevitably to find distant markets for their products. No longer could the manufacturer sit at home and await the buyer. His product was too large and its burden was too heavy to carry on a hap-hazard sales plan. Consequently, the selling departments of all enterprises grew tremendously in importance. Customers were sought across the breadth of a continent. Many a manufacturer's sales area grew, in the span of a generation, from a few hundred square miles to a region that included every degree of climate from the arctic to the torrid. To accomplish this result, efficient selling methods and economical and fast transportation were required. As a natural consequence of these conditions trade-marks grew in importance. Manufacturers without trade-marks found that they had no hold on their trade. The consuming public did not know them or their products by name, and they were at the mercy of the jobber, the wholesaler, and the retailer. They were supported by a chain of circumstances, of which every link was weak.

On the other hand, manufacturers whose trade-marks were firmly fixed in the public mind by reputation, began to see that they were, to a large degree, independent of the merchandising chain. The ultimate consumer knew their trade-marked products, and asked for them by name. Thus, by a process of natural evolution, the trade-mark developed in importance from a workman's tool mark to a symbol of good will—a business asset in a tangible form.

It is an axiom of legal philosophy that when a thing becomes valuable or desirable, legislation concerning its regulation and protection springs into being. Consequently one looks for, and finds, the beginning of specific legislation on the subject of trade-marks around the end of the first quarter of the nineteenth century.

Before the first trade-mark legislation, cases of infringement fell under the common law, and were decided in courts of equity.

H. D. Nims, a well-informed writer on trade-marks, says in his "Law of Trade-marks and Unfair Trade":

> It is rarely that one life sees the genesis and maturity of law, yet it has almost seen them of trade-mark law. In the eighteenth century there were a few scattered decisions which turned almost wholly on the question of fraud. With the rise and growth of machine-made merchandise in the earlier part of the last century, the matter of private marks of merchants to distinguish wares going out into the public markets of the world assumed importance and cases multiplied. Trade-mark law is one of the results of machinery. It is safe to say that the great mass of trade-mark and unfair-trade law is the development of the last forty years.

A structure, of which the foundation has been so recently laid, must necessarily be still unsettled. The rulings of both the Patent Office and the courts are, in many cases, contrary to precedent. In some instances, courts in different parts of the country have handed down contradictory decisions bearing on the same question. But, despite these drawbacks, a body of trade-mark law is being slowly formed, and it is only a question of time before our feet will be on firm ground.

Trade-mark cases should be entrusted to lawyers who have specialized in this branch of the law. The legal status of this subject is changing so swiftly that an ordinary lawyer, absorbed in general practice, cannot keep track of it.

A trade-mark has been defined as "any sign, mark, symbol, word or words which indicate the origin or ownership of an article as distinguished from its quality, and which others have not the equal right to employ for the same purpose. In its strictest sense, it is applicable only to a vendible article of merchandise to which it is affixed." (Ball v. Broadway Bazaar, Court of Appeals, N. Y., 87 N. E. 674.)

We give this definition because it expresses in the fewest possible number of words the function and limitations of trade-marks. Also, because there is in the minds of many business men, a confused notion of the difference between a trade-mark and a trade-name. By referring to the definition it will be noted that a trade-mark is "applicable *only to a vendible article of merchandise to which it is affixed*."

On the other hand, a trade-name applies to a business as a whole, although this business may be engaged in the sale of not one vendible article only, but a thousand. For instance, "Wanamaker's" is a trade-name and "Kodak" is a trade-mark.

A trade-mark has no value except that created by the quality, sale, popularity and profit in the article to which it is affixed. No matter how distinctive or attractive a mark may be, it is worth but little if it is used in connection with an inferior article or with an article sold without profit.

But a distinctive and suggestive trade-mark is of immense help in advertising and selling. Consider, for example, the trade-mark of Old Dutch Cleanser. It is full of *human interest, motion, life,* and *suggestion.* It brings up in the mind the mental picture of dirt fleeing from an energetic Dutch scouring woman. That this mark has been a powerful aid to sales is obvious. Suppose Old Dutch Cleanser had been called Climax Cleaning Powder? Can you imagine anybody getting together anything more than the most languid interest in anything with a name so dull? It reminds one of hard and sordid toil.

Notes for Inventors

Wanted: A Domestic Dough Kneader.—Boys down South can remember how their mothers made beat biscuits, known as "Maryland Biscuits." By means of a fluted roller of hard wood journaled in upwardly projecting cleats at the sides of a bread board, the material was mixed. The roller had a hand crank. The board was large and clumsy and it was quite a job to hold the board and turn the roller in the stiff dough. Why does not some inventor devise a small compact dough worker adapted for domestic use, having means for securing it rigidly to a suitable support and so geared as to render its hand operation easy for a woman or child?

To Protect the Aviator.—Francois Rillean of Los Angeles, Cal., in patent No. 1,027,346, provided an inflated double-walled body in the form of a frame having an opening or cavity to receive the aviator, a double-walled roof forming a head protector and the floor of the cavity forming a seat for the aviator.

Opening a Sash Lock from Outside.—If you have ever forgotten your door key and found all windows locked, you will appreciate the importance of this suggestion: Some one should devise a sash lock which can be opened from outside by any person party to the secret. There might be some form of combination or some secretly disposed tripping device, by which the lock could be released whenever the necessity arose. If the improvement lock should be slightly more expensive than the commercial lock, it would only be necessary to apply it to one sash, that on the window most convenient to enter, and it would often be found useful when the door key had been left in the house.

A Trough-shaped Aeroplane.—Joseph A. Williams of Cleveland, O., has patented, No. 1,027,954, an airship in which the plane is in the shape of an open-topped wedge-shaped trough which increases in depth and width from its front toward its rear end, is open at its ends and has a suitably driven propeller at the rear wide end of the trough.

Made Money by Invention.—An attorney tells of a client who went to Washington a little over a year ago to secure a patent. Recently when in Washington, he told of having made sixty-five thousand dollars the past year by the manufacture and sale of the invention. He produced an article that went into almost general use in a very active, prosperous industry and his problem became simply one of supplying a persistent demand. To find an active industry and supply a revolutionary improvement is a royal road to fortune.

Death of Major Janney.—Major Eli H. Janney, the well-known inventor of the automatic car coupler, recently died at his home in Alexandria, Va. The Major was a native of Loudon County, Va., and entering the Confederate army became a staff officer of Gen. Robert E. Lee. Shortly after the war, while engaged in business in Alexandria, he conceived the idea of the automatic coupler which for so long bore his name, "Janney coupler," and was a representative of the type which has come to be known as the M. C. B. or "Master Car Builders" coupler. He soon demonstrated the practicable character of the invention by its actual use on a Virginia railroad, and the importance of his invention is acknowledged throughout the entire railroad world. Although more than eighty years old at the time of his death, he is said to have been engaged up to about two years ago, when stricken with his last illness, in experimenting with improvements upon his original invention.

Safety Appliance for Airships.—Louis W. Stolp of Washington, D. C., has secured a patent, No. 1,029,475, for a safety appliance in which there is a movable element which holds the operator's seat in place upon the framework of the machine. A parachute is connected with the operator's seat and has automatic means to open its umbrella portion. Means are provided for releasing the operator's seat by hand from its connection with the framework of the machine and means are also provided which automatically release the opening means for the umbrella portion when the seat is released. By this construction, in case of accident, the operator can relea[illegible] seat from the machine and will at the [illegible]ime release the umbrella portion of [illegible]rachute, so it may operate to con[illegible] his descent.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information There is no charge for this service **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated MUNN & CO., Inc.

Inquiry No. 9240 Wanted, addresses of owners of limestone beds running not less than 98 per cent, and near a railway

Inquiry No. 9241. Wanted addresses of owners of deposits of molders' sand suitable for heavy castings

Inquiry No. 9242.—Wanted, addresses of makers of bag valves.

Inquiry No. 9243.—Wanted address of maker of Rover's monogram embossers

Inquiry No. 9244. Wanted, address of manufacturers making rollers, scrapers, and driers suitable for making soap leaves

Inquiry No. 9246. Wanted, addresses of parties having raw materials or minerals containing potash in any form

Inquiry No. 9247.—Wanted, to buy a Parmelee aerated water

Inquiry No. 9254.—Wanted the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on

Inquiry No. 9255.—Wanted to buy a patent roller, a ball bearing axle which could be purchased on a royalty basis, it must be cheap and fully proved.

Inquiry No. 9256 Wanted addresses of parties having Pitchblende deposits if able to ship ore

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert

Inquiry No. 9260.—Want addresses of parties able to ship corundum garnet flint, emery or any material suitable as an abrasive

Inquiry No. 9261.—Wanted, a manufacturer to make card games

Inquiry No. 9262 Wanted, to buy a glass which is a conductor of electricity and the address of the makers of the same

Inquiry No. 9263.—Wanted name and address of manufacturer of pantaloon stretchers with clamps which is capable of being folded up

Inquiry No. 9264.—Wanted the name and address of manufacturers of Date Pitting Machines.

Inquiry No. 9265.—Wanted, names and addresses of manufacturers of machinery for making picket fences

Inquiry No. 9266. Wanted, to buy machinary for fastening wire cloth to wooden frames with coppered tacks

Inquiry No. 9267.—Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9273.—Wanted to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9274.—Wanted, the name of a manufacturer of a machine to make cushion covers for fruit crates

Inquiry No. 9275. Wanted, name and address of manufacturer of stock patterns of platen job printing presses

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00

Inquiry No. 9277. Wanted. A machine for packing dry batteries.

Inquiry No. 9278. Wanted. A machine for separating crab meat from the shell.

Inquiry No. 9279. Wanted. A machine for shredding asbestos board.

Inquiry No. 9281.—Wanted to buy machinery for bleaching walnuts and ivory nuts.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

BELT.—T HERSHKOWITZ, 944 Union Ave., Bronx, N Y. This invention provides a resilient belt for trousers mounted upon the waistband thereof to maintain an approximately constant pressure on the person of the wearer while expanding to accommodate the movement of the person; provides resilient means for said belt to increase the period of service of the belt; and provides guide members for the belt, said members being attached to the trousers.

Pertaining to Aviation.

AEROPLANE.—D. R. DAVIS, Franklin and Willard Sts., Hollywood, Los Angeles, Cal. This invention is applicable to various types of aeroplanes, but particularly applicable to that type in which the balancing is effected by a relative movement of the parts of the main supporting plane Automatic means provide to keep the main body in its proper position when cross or vertically-directed currents of air are encountered.

Electrical Devices.

TELEGRAPHING INSTRUMENT.—C. E. FERGUSON, 841 St Nicholas Ave., Manhattan, N Y. This invention produces an instrument attachable to a typewriting machine for use in conjunction therewith whereby the telegraphing instrument is operated in harmony with the typewriting machine; produces an instrument which may be adapted as an attachment to typewriting machines of usual construction; and provides an attachment wherein the telegraphing circuit is closed when the use of the instrument is discontinued.

Of Interest to Farmers.

PLANTER.—R ALLEN, Mason, Okla. Mr. Allen's invention provides a planter which will plant the seed at varying depths and thereby secure a better stand As with this planter some of the seed are planted near the surface, while other seed planted nearby are planted an inch deep, the farmer using this planter will be certain in all cases of obtaining a good stand no matter what the weather conditions may happen to be.

GANG AND MOTOR PLOW.—E. B. SELLARD, 618 Franklin Ave, Mexico, Mo. The object of the invention is to effect an improvement in means for attaching, suspending, and adjusting plows with reference to a frame supported upon wheels which is supported on wheels When an obstruction is met, the plows and frame rise until it is passed, when they resume their proper position

GEARING FOR MOTOR DRIVEN PLOWS.—E B SELLARD, 618 Franklin Ave., Mexico, Mo In order to provide for driving a plow at high or low speed and steering the plow by power as well as by hand, Mr. Sellard connects the motor by sprocket gearing to the countershaft, which in turn drives a supplementary shaft, a double clutch being employed that will throw either a step-down or a step-up gearing into action. The traction wheels are driven by the supplemental shaft through a pair of clutches, either one of which may be disengaged to release the wheel it controls, and thus permit of steering the plow by motor power

Of General Interest.

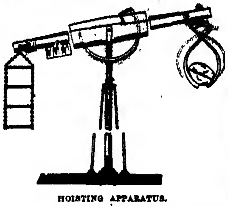
PORTABLE DERRICK.—M. G. BEAN, Walcott, N D This derrick is capable of being carried around by hand or on wagons and handled preferably by one person. It comprises a pair of posts swiveled relatively to each other and adapted to be folded to different angles relatively to each other for different purposes and embodies a number of structural improvements whereby its efficiency as a derrick and its compactness and adaptability are greatly increased.

CREDIT ACCOUNTING APPLIANCE.—A. L LAMBERT, Concordia, Kan. The intention in this case is to provide an appliance more especially designed for the use of merchants, to keep the accounts of customers who buy on credit in a very simple and accurate manner, to allow a salesman to readily ascertain the customer's account, and to permit such salesman to make additions to the customer's account

BOX.—W S ADLER, care of Empire Plow Co, Cleveland Ohio. One purpose of this invention is to provide a box having a plurality of shelves movable relative to one another so as to expose simultaneously the contents of all the shelves, which can be folded up in a convenient air tight manner, so that the contents will be protected from dust and dirt and kept perfectly fresh

MOLD.—H W STRIETELMEIER, Route No 2, Linton Ind The object here is to provide a mold more especially designed for making concrete fence posts and like articles, and arranged to allow convenient and secure removal of the post after being molded to permit immediate re using of the mold for forming another post while the first one is setting.

HOISTING APPARATUS.—F. M. DAUGHERTY, Byron, Wash. This invention relates to hoisting apparatus for handling bags or bales, or other merchandise, and has reference more particularly to apparatus of this class which comprises a beam, means associated therewith for holding a load, means for gravitationally operating the beam to raise the load, and automatic means controlled by the load-holding means for locking the beam against movement in one direction. Besides



HOISTING APPARATUS.

being useful in warehouses, it can advantageously be used in lifting and transferring weights from point to point. The engraving shows a side elevation of an embodiment of the invention, having parts in cross section and parts broken away.

DRYING TABLE.—F. I. BURCHER, care of Acme Cloth Shrinking Machinery Co., 11 E. 4th St., New York. The cloth in the piece is passed over the table to dry before shrinking it, the table being arranged to insure uniform drying of the fabric with the greatest economy of steam used as the heating medium, the table being made in sections capable of being readily set up, or taken apart for packing in a small space, for shipping, storing, etc.

Heating and Lighting.

INCANDESCING ELEMENT.—D. J. MONOSMITH, Spencer, Ohio This inventor has produced an incandescing element made up of laminæ or plates, each plate being weakened by aid of score lines so as to cause the plate to break along said lines if it breaks at all, thereby preventing fracture of the element along any line or plane except one parallel with said score lines or with plates.

Household Utilities.

TEA BREWING APPARATUS.—C. A. SHERMAN, 381 4th Ave., Manhattan, N. Y. This invention provides an urn composed of two independent units, in the upper one of which the tea or other infusion may be brewed and directly withdrawn from the same; or the infused liquid may be withdrawn from its contact with the tea or other substance from the lower unit or receptacle.

Machines and Mechanical Devices.

MATCH MAKING MACHINE.—S. E. RAHR, 918 Madison St., Brooklyn, N. Y. This invention relates to match making machines having an endless chain of carrier plates for securing the splints and carrying the same from device to device for automatically completing the matches and finally ejecting the same

Pertaining to Vehicles.

DRIVING GEAR FOR MOTOR VEHICLES.—O. J. GRAN, Callahan, Cal. This improvement provides a driving gear for automobiles and other motor vehicles, arranged to transmit the power applied by the motor to the rear axle to the front axle without interfering with the steering gear, to compensate for the variation of speed of the front or steering wheels when turning from a straight path, and to prevent skidding.

AUTOMOBILE.—W E. STANLEY, care of Bank of Bay Biscayne, Miami, Fla. In this vehicle the frame carrying the motor may be raised considerably above the ground and be supported in this position, so that the plow shares or shovel members may be carried between the wheels and below the frame, to work the soil as the automobile is driven by its motor. The machine may readily be converted from a pleasure vehicle to one carrying plow shares for working the soil, and cultivation of tall crops.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

NEW BOOKS, ETC.

ENGINEERING FOR LAND DRAINAGE. A Manual for the Reclamation of Lands Injured by Water. By Charles Gleason Elliott, C.E. New York: John Wiley & Sons, 1912. 12mo.; 339 pp.; illustrated. Price, $2.

The United States have before them greater drainage problems and possibilities than any other country of the world. Since the drainage of the tract now known as Central Park, in 1858, progress in land reclamation has been steady. The work issues increasing calls for the drainage engineer, and students will find in this concise text much needed information. Fieldwork equipment, engineering technique, the preliminary survey, underdrains, flow in open channels, the location and construction of open ditches, levee systems, the reclamation of tidal lands, the drainage of irrigated, peat, and muck lands—all these phases of the subject are set forth, with useful tables, and instruction as to making close estimates and keeping adequate accounts and records.

DREDGES AND DREDGING. By Charles Prelini. New York: D. Van Nostrand Company, 1911. 8vo.; 279 pp.; 82 illustrations. Price, $3 net.

The first power dredge of which we have any knowledge was designed by one Cornelius Meyer in 1685. It utilized horses in the construction of canals and dykes in Holland. It is a far cry from that clumsy and inefficient piece of apparatus to the marvelous machinery of the modern dredge, which has made possible so much of our present commercial development. The debt of navigation to the mechanical digging machine exceeds only that of drainage and irrigation, water supply and mining. All are under heavy obligation to the dredge for the breadth of their accomplishment. The volume in hand treats of this important subject from all points of view—the nature of soils encountered, the method of taking soundings and hydraulic surveys, the excavation of subaqueous rock, the types of dredges employed in various works and their classification and capacity, hydraulic and pneumatic dredges, dipper and grab dredges, and cost data The engravings show plainly the distinctive features of the various types and the relation of these features to the work performed. Mr. Prelini has given us a book that is instructive and fascinating in a very high degree.

COMMENTARY ON THE SCIENCE OF ORGANIZATION AND BUSINESS DEVELOPMENT. By Robert J. Frank, LL.B. Chicago: Chicago Commercial Publishing Company, 1911. 8vo.; 280 pp. Price, $2.75.

The author states, and the facts sustain his contention, that a business soundly founded is at least one third a success: the other two thirds being acquired by opportunity and adequate facilities. It is more essential than the average incorporating group realizes that it should clearly understand the advantages and limitations of a corporate body, and the specific advantages which they desire to enjoy: otherwise it remains for future disagreeable developments to enlighten them as to the errors of their initial step. It is not sufficient, as the author emphasizes, that they rely wholly upon the judgment of counsel The treatise covers in a common sense manner all the usual considerations confronting the organizers of a business corporation. Financing, management, reorganization and consolidation, are plainly set forth, and the promotion of enterprises fittingly receives a separate chapter An appendix contains contract forms, certificates, by-laws and resolutions, a synopsis of the corporation laws of those States most lenient toward this form of organization, and rules for listing stocks and bonds, with a table showing their earnings Incorporators, officers and directors, financiers and accountants will all find this work a reliable desk guide.

WARSHIPS AND THEIR STORY. By R. A. Fletcher. London, New York, Toronto, and Melbourne: Cassell & Co., Ltd., 1911.

In writing this work the author disclaims any intention of treating of the structural problems relating to warships, or intricate matters of strategy and tactics, his aim having been to describe in popular non-technical language the more important types of warships favored at different times in different parts of the world. He shows how type has succeeded type, and he describes the main lines of divergence and development. The author reverses the usual practice of treating the warships as incidental to the naval battles, preferring to treat the naval battles as incidental to the warships. The work opens with an introduction, which forms one of the most readable and instructive chapters of the book, and is in fact a digest of the volume which follows The historical chapter tracing the development of the warship, from the ancient Egyptians to the day of the introduction of artillery, is particularly readable, as are the chapter on iron ships of war and that dealing with guns, projectiles, and armor. The work is written for the layman. It gives him the kind of information he wants, and gives it in an interesting way. The author has done his task well The half-tone work of the book is particularly good, and the subjects of illustration are well chosen

A SHORT COURSE IN GRAPHIC STATICS. For Students of Mechanical Engineering. By William Ledyard Cathcart and J. Irvin Chaffee, A.M. New York: D. Van Nostrand Company, 1911. 12mo.; 133 pp.; 56 illustrations. Price, [illegible] net.

The Efficiency of the Large Manufacturing Plant

By Sidney Graves Koon, M.M.E.

READING between the lines of the census bulletin detailing manufactures in New York State, one of the first State reports issued, and covering 16.3 per cent of the total manufactures of the United States, a number of interesting facts are disclosed. It is found, as was to have been expected, that the proportionate output of large establishments is increasing, while that of small plants is decreasing. It also appears that the efficiency of production in the large plant is much higher than in the small one, more product per man is turned out, and (what is of greater real importance) a larger value per man is added to the product as a result of the manufacturing processes. And this "efficiency" has itself shown a marked increase during the five years between 1904 and 1909, covered by the census investigations.

The first item mentioned is due to the concentration of effort and capital, in small plants and small industries as well as large ones, to combinations of men and enterprises, to the rapidly developing idea in manufacturing which has been so aptly expressed in the State motto of Kentucky: "United we stand; divided we fall!" Co-operation is the keynote, and it is finding expression in establishments of all sizes. So it follows that the ratio of the output of the large plants to the total output is increasing.

Plants with an individual annual product of $1,000,000 or more numbered 294 in 1904 and 470 in 1909. They employed 20.9 per cent of the total number of wage earners in 1904 and 25.4 per cent in 1909. They furnished 32.8 percent of the products in 1904 and 37 per cent in 1909. They added value through manufacturing processes amounting to 25.9 per cent of the total in 1904 and 31 per cent in 1909.

A comparison of these figures will show that these large plants produced about 50 per cent more output per man than the average of all plants, and 80 per cent more than did the 40,000 smaller plants. In value added through manufacture, the large plants showed 23 per cent more per man than the total average, and 32 per cent more than the smaller plants. This establishes our second point, the increased economy of operation of the large plant. And it is due in large measure to better facilities for handling materials, cranes and other labor-saving machinery, improved railroad connections and service, and less of the "jack-of-all-trades" in the make-up of the "hands." To what extent the new fad "scientific management" has influenced this result is problematical.

The general gain in efficiency all along the line is shown by the figures for all the five groupings given in the census bulletin, plants with less than $5,000 output; between $5,000 and $20,000; between $20,000 and $100,000; between $100,000 and $1,000,000; and over $1,000,000 annually. The gain in the establishments as a whole was from $2,904 product per "hand" in 1904 to $3,356 in 1909, an increase of 15.6 per cent. In value added during the processes, the gain per hand was from $1,330 to $1,507, or 13.3 per cent.

All of these points are best shown in the subjoined table. In the table, all figures for total values of products and total values added, represent millions of dollars. The total products amounted to $3,369,490,192 in 1909 against $2,488,345,579 in 1904, a gain of 35.4 per cent. The total value added in manufacturing increased from $1,139,742,293 in 1904 to $1,512,585,850 in 1909, or 32.7 per cent. The value added represented 45.8 per cent of the product in 1904; 44.9 per cent in 1909.

Annual Product per Plant	Date	Wage Earners	Millions of Dollars		Dollars per "Hand"	
			Product	Value Added.	Product.	Value Added
Over $1,000,000	1909	255,383	1,246	469	4,879	1,835
	1904	179,488	816	295	4,547	1,646
$100,000 to $1,000,000	1909	438,229	1,413	664	3,224	1,516
	1904	393,872	1,103	531	2,799	1,349
Under $100 000	1909	310,369	711	380	2,290	1,223
	1904	283,587	570	313	2,009	1,104
Totals—All Plants						
	1909	1,003,981	3,369	1,513	3,356	1 507
	1904	856,947	2,488	1,140	2,904	1,330

Conquering Infection

THE epic work of Gorgas and his associates, by which one of the greatest plague spots on the face of the earth has been turned into a veritable health resort, is now known and appreciated throughout civilization. It is gratifying to realize that like work has been doing in many other tropical regions.

For example, the Gold Coast and other West African colonies have long been branded as graveyards of white colonists. From 1881 to 1897 the white Gold Coast mortality averaged 75.8 in the thousand for each year, in Lagos it was 53.6. Since 1897, however, mosquitoes and rats have been fought on lines laid down by the scientific bacteriologist; water supplies have been purified and protected; and antityphoid inoculations have been made. The result? In the years 1903-1906 the death rate was 24.3; during 1907-1911 it was 17.6; in 1911 it was 13.7. Here is a record fairly emulative of Panama.

India, the home and the source since the dawn of history of many a "world pestilence," has now a standing British army of about 72,000 men, among whom malarial fevers are the most common illness; formerly typhoid was by far the most deadly. Comparatively little progress has been made against the malarias but the enteric diseases have been so well combatted by means of sanitation and inoculations that one might almost be sanguine of their extinction. Five years ago the death rate was 2.66 in the thousand, a marked reduction from former years; in 1910 it was reduced to 1.58; in 1911 it was but 0.63. Nor was all such improvement monopolized by the white residents and soldiers. Among the native Indian troops, which are nearly twice as numerous as the British similar progress has been made. While in the whole native population of "fatalistic" India (which has from time immemorial, up to a few years past, looked upon cholera and the plague as "visitations" it were impious to defy) the death rate in 1910 was 33.20 in the thousand, as against 35.40 in the preceding five years; the birth rate rising *pari passu* from 37.51 to 39.52.

Such achievements as these are in truth but part of a world-wide and constantly more and more victorious fight with disease, and especially with epidemics against which mankind has ever, up to our generation, been almost defenseless. Thus, by reason of the necessities of tropical colonization, are infectious diseases being eliminated from those regions; though of course medical science cannot remedy the high temperatures, which induce in the Caucasian the "tropical wrath," characterized as it so sadly is by intemperance, lassitude, periods of spasmodic mania and of hideously cruel acts toward inoffending and defenceless natives.

When such triumph over disease can be achieved despite the formidably adverse conditions obtaining in the tropics there should be an even greater measure of success in the temperate zone; while failure to eliminate disease-transmitting insects, and to preserve foods and waters pure, must in reciprocal degree be discreditable in those regions of the earth where sanitation is easier to effect and civilization more advanced.

Bacterial Purification of Water and Sewage

(Concluded from page 37.)

Nevertheless, the rural community and the large private estates in the country have similar problems which have to be faced and solved. In the latter case, especially where convenience has demanded an up-to-date water system, there is the greatest need of a careful scientific study to the end that the final disposal of the wastes shall be safe and complete. As a rule too little attention has been given to this phase of the subject by those most interested. It is generally thought sufficient to get the sewage out of sight under the ground somewhere and as long as no obvious nuisance arises, no further thought is given to it. The fact must be borne in mind that the purifying agency of the soil lies quite close to the surface. At moderate depths, these being greater with the more open soils, the air supply is insufficient for the proper action of the bacterial life and the continuous discharge of sewage under ground in such a way that it tends to sink into still lower depth is a mere evasion of the real problem. This sewage mingles with the ground water and will reappear at some point, possibly remote, possibly in the well or spring of the same place, or of a neighbor, but in all cases practically unchanged in character. Examples are not lacking in which disease-producing bacteria have been conveyed many hundreds of feet through compact soil. Several typhoid fever epidemics resulting from such a situation have been recorded. The water and sewage problems of country homes depend upon so many local factors that any general discussion of them would be quite futile. This is a matter, however, which justifies most careful study in each particular case, and the science of sewage disposal has now advanced to such a point that satisfactory and economical solutions are always possible.

Insects and Disease

(Concluded from page 34.)

the non-immune population. Since this mosquito breeds by preference in fresh, clean, quiet water, the first thing to do in attacking this species is to render collections of water inaccessible to the mosquito. These are usually found to be water-containers of various sizes, such as barrels, tanks, cisterns, tin cans, sags in roof-gutters and the junction of the leaves with the stem on plants of the *Agava* family. Breeding places may be screened, drained, salted, oiled, stocked with fish or destroyed.

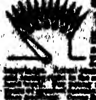
It is also necessary that measures be taken to prevent the mosquito from becoming infected and to this end all cases of fever occurring in the yellow fever belt should be screened for the first three days of illness, and upon the recovery or death of the patient the house should be fumigated to kill mosquitoes. For this purpose, sulphur dioxide, which may be produced by burning sulphur in the proportion of two pounds to the thousand cubic feet of initial air space, is perhaps the best agent. Mosquitoes may also be killed by burning pyrethrum or tobacco, but these latter methods are less efficacious. It should be borne in mind that formaldehyde which is used as a fumigating agent for certain diseases will not kill insects. It is interesting in this connection to note that in those locations in the tropics where yellow fever is endemic the disease is probably kept alive by infants in arms who have it in mild form and thus continue the cycle between the mosquito and the human species.

The yellow fever mosquito is essentially a domestic animal and as far as its relation to the disease is concerned need be considered only in connection with its proximity to the home of man. The malaria mosquito on the contrary does not necessarily live in close proximity to man and will breed in almost any deposit of fresh water which is quiet and not stocked with fish or insects which destroy the mosquito larvæ. The same general methods of extermination as outlined above may be used, but they should be carried on in a

wider radius and should include the drainage of swamps. In addition, the human cycle of the disease may be partially controlled by the daily administration of small doses of quinine to all persons living in the infected zone. Also, it should be the rule to sleep under a well constructed bed-net and endeavor as far as possible to avoid being bitten by mosquitoes at all times. To-day malaria is the great scourge of the tropics. It has laid waste and prevented the occupation by the human species of a greater portion of the globe than any other disease. The Island of Mauritius for example, whose name was formerly synonymous with good health has in recent years had an enormous amount of malaria due to the introduction of the *Anopheles* by ships and the importation of the germ in the persons of immigrants, with the result that what was formerly a great sanatorium is now an endemic malaria focus. Since this disease may be controlled and limited by the extermination of *Anopheles* mosquitoes, it is the duty of communities in which this species abounds to rid themselves of this menace to health and commerce.

Reference has already been made to the rôle of the flea in the transmission of plague. This is of extreme importance because plague is primarily a disease of rodents and secondarily and accidentally a disease of man. Almost every fur-bearing animal has fleas which may be easily infected by the ingestion of infected blood. Thus, it is found that the rat flea, the ground squirrel flea, and the tarbagan flea have all been convicted at one time or another of having transmitted bubonic plague. The remedy is obvious. If the animal carrying the flea which bridges the space between the infected rodent and the well human being be excluded from the home of man there need be little fear of bubonic plague. Therefore, the work which was carried on in California for the eradication of plague was directed very largely at the extermination of rodents This may be accomplished by a simultaneous attack upon the home and the food supply of the rat and by killing them by the use of poisons and traps. Plague is out upon its march around the world, and for the past five years has been making a steady advance up the Spanish main Very recently it has appeared in Porto Rico and for all we know it may now be smouldering in the rodent population of some of our large Atlantic seaports. If a survey of these rodents is made now and the foci of infection stamped out much money and many lives may be saved in the future. This is a measure of immediate necessity if we would protect our sanitary and commercial interests.

Not the least interesting aspect of the transmission of disease by insects is the rôle played by the tick in this regard. One species of this insect is known to carry African tick fever and we have a strictly American disease almost wholly confined to the Western States, Rocky Mountain tick fever, which is carried by another species, the *Dermacentor andersoni*. The organism of this disease has not yet been discovered but the season of its prevalence is coincident with the period of greatest tick prevalence and it is found only in those localities in which ticks occur. Two types of Rocky Mountain spotted fever are known. The mild, which occurs in Utah, Wyoming, Idaho, Nevada and eastern California, Oregon and Washington, and the severe form, which is found in Montana. Usually the disease is confined to one side of a valley and in almost every instance there is a history of the patient having been bitten by a tick. Further, the disease has been experimentally transmitted from one human being to another, from human beings to guinea pigs, and from guinea pigs to guinea pigs by the bite of the tick. Active work is now being carried on in Montana by the United States Public Health and Marine Hospital Service for the eradication of the disease. The general plan of operation includes the extermination of the small mammals on which the tick lives during the earlier portion of its developmental cycle and the "dipping" of the domestic stock on which the ticks spend a portion of their adult life in antiseptic solutions. Also, the land on which



locality. This work has been in operation for only a single summer, but it has resulted in the total cessation of cases in what was hitherto a badly infected locality.

Typhus fever, which also goes by the names of "jail fever" and "ship fever," and which in former years was regarded as the inevitable companion of war and famine, until very recently, was thought to have entirely disappeared from our country. It has, however, continued in Mexico where the researches of Nicole, Ricketts and Wilder, and Anderson and Goldberger have demonstrated that it is carried by the body louse, the *Pediculus vestimenti*. Recently Anderson and Goldberger have demonstrated that the head louse, *Pediculus capitis*, may also transmit the disease. More important than all, Anderson and Goldberger, working in the Hygienic Laboratory of the United States Public Health and Marine Hospital Service at Washington, D. C., have proven the identity of Brill's disease, a wide-spread disease in the United States, with typhus fever. It is thus seen that typhus fever of a mild type is prevalent in the United States. Since the disease is carried by lice, and since lice are the almost inevitable companions of filth and squalor, it is seen that the best way to prevent this disease is to kill lice, and by cleanliness to render their environment unsuitable for their existence. Brill's disease, or mild typhus fever, occurs often in children. Lice are found often on children. Lousy children should therefore be excluded from school until they have been freed from this disgusting parasite.

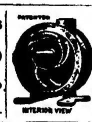
It is not at all improbable that bedbugs also carry disease. While this has not been proven definitely there are numerous instances on record in which the evidence tends to incriminate this species. The remedy is apparent.

The Destruction of the "Schwaben"

THE old wooden airship shed at Duesseldorf is fast gaining a reputation as the aerial "hoodoo dock." When everything about the Zeppelin ships appeared secure at last, after four of them had been making record trips, the "Schwaben" (fortunately insured at her full value against fire) was destroyed as if by a bolt from a clear sky, after her 214th passenger trip, in close proximity to the same Duesseldorf shed that twice wrecked the "Deutschland." She was at anchor, weathering a storm for hours, and trying to avoid a risky entrance into the shed, when a severe gust raised her into the air, broke her back and ignited the escaping gas, presumably by frictional electricity.

The disaster must be ascribed to the over-confidence inspired by handling the ship safely in so many stormy landings, and to the treacherous nature of the wind, which, as aviators well know, may all of a sudden show quite unfamiliar antics and effects. Again the lesson was emphasized that men, even in great numbers, cannot replace reliable anchors. The four concrete blocks sunk into the ground, around which the ship swings like a weather vane, held by a swivel at the ends of four converging cables, were not in use, because these are placed farther from the shed to give room for the ship's movements.

The least expensive way to make old sheds like that at Duesseldorf safe, would be to erect one of those anchoring towers of steel lattice work which have been often suggested, and around which the ship at anchor could swing in safety, clear of the ground, until the wind's subsiding permitted the safe entrance into the shed. The English army has tried this plan with excellent success on a small scale. An interesting feature of the "Schwaben's" disaster is its resemblance to certain aeroplane accidents. The breaking of the airship's back was due to the same causes that have stripped monoplanes in the air of their wings—the great resistance of the inertia of concentrated weight against yielding under a very sudden and heavy wind pressure. It could have been avoided by lightening the cars [illegible]



This would have equalized the strain. If the weight of the passengers had still been in the cabin, possibly nothing would have happened, for the airship did not really break away, as otherwise the men holding it would not have been burned. Such "explosive" lifting effects of wind gusts can also occur only near the ground and near obstacles like the shed, where the gust may "jam" under the ship. It should be noted that the "Schwaben" was not pushed back, but lifted straight up like an aeroplane. It would do no harm to relieve the cars in future of all tanks, stores and other weights that can be possibly arranged along the passageway, as already done in the Siemens-Shuckert dirigible, although there is ample strength for free flight.

If there had been no smashing there would have been no escaping gas and no electric sparks to ignite it. But a water sprinkling device (tried on the "Suchard") inside the hull and above the ballonets could easily guard against frictional electricity in critical situations, and German manufacturers are now hard at work upon a balloon cloth that cannot be electrified by friction or concussion even in dry air.

The Current Supplement

IN this week's SUPPLEMENT, No. 1906, Arthur J. Hoskin discusses very lucidly the legal and technical points which require consideration in connection with the opening of new mines.—C. M. Chapman writes on Methods for Testing Coatings for Cement Surfaces.—A richly illustrated article by L. Claremont tells our readers of the wonderful gem industry carried on by the natives in Ceylon.—The benefits to mankind which have been gained by experiments upon animals cannot be brought with too great emphasis before the public. Much has been written on the subject, but the article which appears in our current issue is one of unusual merit and persuasive force and should be read by all, especially by those who perhaps may not be very fully informed on the subject and may possibly still entertain some doubt regarding the great gains which medical science has to record in this quarter.—Day Allen Willey contributes an illustrated article on the remarkable engineering feat accomplished in the building of a railway in ice-bound Alaska.—A report of some tests of a simple engine taking steam at less than atmospheric pressure is of particular interest in connection with the utilization of solar energy.—Dr. Zahm, the noted American authority, contributes a masterly article on Elements of Theoretical Aeromechanics, which will run as a serial through two or three issues.

Centennial of Gas

WHEN and where gas was first used, it seems to be difficult to ascertain. Yet 1912 is regarded as the one hundredth anniversary of the introduction of illuminating gas. Apparently the event to be celebrated is the organization in 1812 of the London Gas Light and Coke Company. Gas, however, was used for illuminating purposes long before. Murdoch used it for lighting as early as 1795 and perhaps earlier. At all events, in 1798, he put up a gas plant for Boulton, Watt and Company, in Soho. The American city of Baltimore is credited with being the first to apply illuminating gas practically to general illumination. There was a small plant in Newport, Rhode Island, as early as 1813, which antedates the Baltimore plant by eight years.

Tunnels in Constantinople

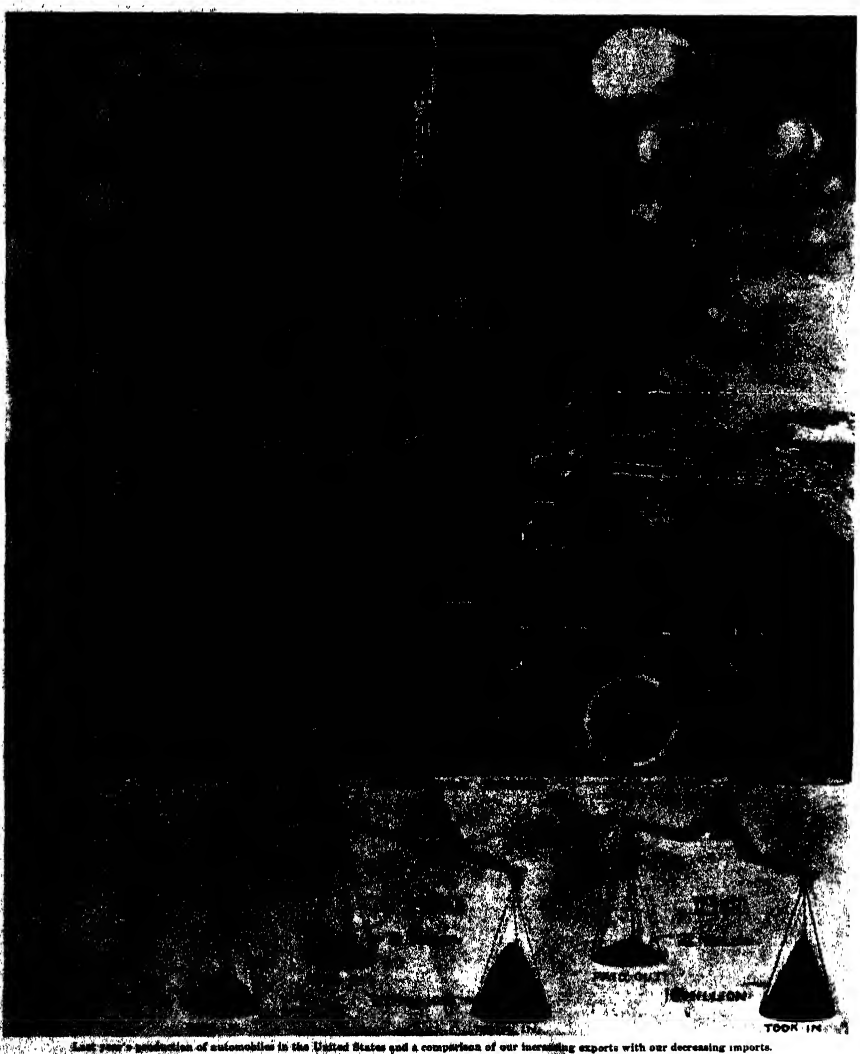
IT is reported that the Turkish council of state is studying a plan for an underground railway to connect Stamboul with Pera, under the Golden Horn. A more ambitious plan, which English engineers are said to have in hand, contemplates a double tube under the Bosporus, between the extreme points of Stamboul and Haidar Pasha, to connect the railway systems of European and Asiatic Turkey.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 3.] NEW YORK, JULY 20, 1912 [10 CENTS A COPY $3.00 A YEAR



Last year's production of automobiles in the United States and a comparison of our increasing exports with our decreasing imports.

THE GROWTH OF THE AUTOMOBILE INDUSTRY.—[See page 63.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 20, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions
Mexico, Cuba, and Panama
Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid, . . . 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $3.00
Scientific American Supplement (established 1876) . " 5.00
American Homes and Gardens . . . . " 3.00
The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Human Fallibility and the Automatic Stop

THE theory of the automatic block signal system as applied to railroads for the prevention of collisions is perfect. Its practice as carried out day by day on the railroads of the country, proves that it is not the absolute preventive of collision which we hoped it would prove to be. From time to time there have occurred serious railroad disasters which an effective working of the block signal system should have rendered impossible. The latest and most frightful of these were the rear end collisions at Corning, New York, and Latrobe, Pennsylvania, when nearly one hundred people lost their lives, and an even larger number were injured.

It is not sufficient to say that these accidents were due to the human element, which can never be controlled by any mechanism, howsoever ingenious and effective it may be. A block signal system, if it is to do its work, must make it impossible for two trains to be in the same block at the same time. This, the present system cannot do in those cases where there is negligence on the part of the operating staff.

In the Corning disaster, the engineer ran by two block signals, and appears to have taken no notice of a third signal, placed in the rear of the stalled train by the brakeman. In this case, the collision was due either to the carelessness, wilful disobedience, or mental and physical incapacity of the engineer. Just how he came to run by these signals will be shown during the official investigation.

The point we wish once more to emphasize is that the block signal system, as at present laid out and operated, is not absolutely effective. It lacks one element, simple and readily installed, which, if it were present, would render block signalling absolutely effective as a preventive of collision. We refer to the automatic stop.

The automatic stop is as essential to a properly-constructed block signal system as the trigger is to the gun. This gruesome Corning disaster simply emphasizes a fact which this journal has many times proclaimed in the past few years, namely, that the excellent idea embodied in block signalling can be made absolutely effective only by rendering it mechanically impossible for a train to run by a signal.

It is "up to" the railroads to install the stop on all important lines carrying mixed traffic. At present they do not look favorably upon this mechanism. They dislike the first cost and they have an equal dislike for the cost of maintenance.

We commend to the consideration of the Interstate Commerce Commission—that fine body of men which is doing such magnificent work, both for the railroads and its patrons—the necessity for the installation of the automatic stop on all important lines carrying a heavy and mixed traffic of express and passenger trains. The device should be so arranged that when the semaphore arm is up, the trip will be up. Moreover, the trip should operate to close the throttle and apply the brakes simultaneously. Also there should be some self-locking recording arrangement, by which the locomotive, when it has been tripped carries back to the round house a visible record of the fact that the engineer has run by a signal.

Railroad managers complain bitterly of the lax ideas of discipline which prevail among the operatives of American railroads, and name this as a fruitful cause of accidents. The best corrective is to place the careless operator under automatic control.

The Fate of Vaniman

ALTHOUGH there was no survivor to the dreadful catastrophe that blotted out what has been the most determined attempt so far to supply America with at least one dirigible of businesslike proportions, it is by no means so difficult to point out defects in the "Akron," which rendered it liable to such an accident.

Building a dirigible balloon of large size is a problem that bristles with engineering difficulties, especially if the balloon is to be non-rigid, as was the "Akron." It calls for a man who is not only a clever mechanician and inventor, but an architect and civil engineer of high order.

The large European non-rigid dirigibles have been developed step by step. The first Gross, Parseval, and Lebaudy airships were very small; the first "Ville de Paris," a mere enlargement of the Santos Dumonts, was a complete failure.

Vaniman began with the size of almost the largest European non-rigid dirigibles. It did not follow any European model. The shape of the envelope did not show any "speed lines" (such as those developed in the laboratories of Europe); there were no adequate steadying fins; the rudders were too small; and while the 280 horse-power propelling plant was rather weak for the displacement so that the speed could only be quite moderate, there were no aeroplanes to counteract the changes in the gas lift, as in the large French dirigibles with moderate power.

We must remember, however, that the "Akron" was not built to sail over land, which explains the departure from European design. It was intended particularly for a transatlantic venture, and as economy of fuel was a vital factor, Mr. Vaniman intended to drift as much as possible. To attempt to drive the airship across the ocean at a speed of forty to fifty miles an hour, such as attained by European dirigibles, would have required more fuel than he could very well have carried. Mr. Vaniman was, therefore, trying to build a new type of airship which we may call a "drifting dirigible," contradictory as the term may seem. Such being the case it was not necessary for him to use more than one or possibly two engines at a time, as he desired to make little more than steerage way. With a weak power plant and a machine that was to be blown by the winds, the "aeroplane lift" idea was discarded. Instead, Mr. Vaniman depended upon driving his airship down by means of orientable propellers and also by pumping air ballast in the ballonets until he could come near enough to the surface of the sea to pick up water ballast in his "hydroelevator."

It is probable that Vaniman, when he found the hot July sun squeezing all the air out of the air ballonets, against the heavy weight on their safety valves, and trying to expand the gas still further, depended on preventing further ascension by keeping the gas forcibly in the envelope under compression. Just why he did not drive the machine down with his orientable propellers who can say? He had two sets of them, one pair driven by an 80 horse-power engine and another by an engine of 200 horse-power. It was the first ascension of the "Akron" on a hot summer day. Accounts clearly establish the fact that the airship, when the sun gained its full power, began to rise steadily until everybody wondered about the unprecedented and uncalled for altitude. It ascended until all the air was forced out of the ballonets; then it burst. It is now evident that the first reports were erroneous. The gas was not set on fire. The uncharred envelope is conclusive evidence of the fact that fire played no part in the catastrophe.

The whole occurrence is a close parallel to the fate of Oskar Erbslöeh's dirigible in 1910, that burst in the air, when it suddenly emerged from a dense fog into sunshine, killing all aboard. Only in Vaniman's case it came more gradually; in place of a German fog there was the characteristic American summer haze which greatly influences radiation. The higher the "Akron" ascended the more the haze thinned, and the more powerful became the sun. At this moment Vaniman ought to have pulled the valve cord energetically, but it is doubtful whether he realized how much discretion is required in piloting large, non-rigid airships. It is doubtful whether Vaniman watched his pressure gages with the unceasing vigilance which is a point of honor among Parseval captains; it is doubtful whether he had any experience as to how easily they may get out of order, unless carefully looked after (their many long, thin tubes have a trick of getting entangled and choked); it is even doubtful whether there were any such gages at all, for there was one required for every air ballonet, of which Vaniman had so many, and two or three for the gas space, and very probably he disliked the complication and depended instead on a solitary safety valve.

But, having no aeroplanes, unless he had tons of ballast, Mr. Vaniman had a reason for not opening the valve. After the high ascension a fall into the water was very likely to follow the escape of gas, and it was quite logical thus to apply to some extent the principle of the proposed "steel envelope" even to the "Akron," for the strength of whose tough silk envelope Vaniman had given as high a figure as an inch and a half of water. But without a sufficient number of absolutely reliable pressure gages, this was extremely dangerous.

Another point must be considered. The hydrogen-generating facilities at Atlantic City were rather primitive. Any remnant of acid vapor in the gas has a very fatal influence in weakening an airship's envelope. The European "giants" do not use any hydrogen made by the old acid process.

Finally, it should be pointed out that the system of air and gas valves required in a large, non-rigid airship is as formidable an engineering problem as the valves of a gasoline motor. But where a gasoline motor gets stalled when its valves fail to work properly, an airship may burst or fail.

It seems tragical that Vaniman, who has displayed exceptional ingenuity in many details, should have fallen a victim to the neglect of proven facts.

At the same time the actual cause of the disaster may have been something that we have not touched upon. Consider the first trial trip of the "Akron." Who but an eye witness could explain that the failure was due to the accidental dropping of a bag of sand on the water circulating pipe of the engine?

The Latest Triumph of Organic Chemistry

IF proof were needed of the fertility of chemical science as a source of material gains, such proof comes in most convincing form by the recent announcement of the successful completion, by a commercially sound process, of the synthesis of India rubber. The importance of this new trophy of the organic chemist requires no emphasis: the general public is well aware of the great demand for rubber, and the difficulty which has been experienced in meeting it. Prof. Hinrichsen, on another page of this issue, gives us some statistics illustrating this point.

The announcement of the synthesis of India rubber comes from the mouth of Prof. W. H. Perkin, son of the illustrious Sir William Perkin, founder of the coal tar dye industry. Mr. E. H. Strange, of the firm of Strange and Graham, of London, England, some time ago organized a group of investigators for collaboration on the problem of synthetic rubber. The list included, in addition to Prof. Perkin, Sir William Ramsay, Prof. Fernbach, of the Pasteur Institute of Paris, and Dr. F. E. Matthews. That a certain hydrocarbon, termed isoprene, was obtainable from rubber, and could, under favorable, but somewhat ill-defined conditions, be reconverted into rubber, had been known since 1875. It remained to find a cheap source of isoprene and to discover the exact conditions under which its polymerization to rubber could be positively and rapidly brought about. Both these problems have been solved by the group of chemists organized by Mr. Strange. Prof. Fernbach, as a result of some eighteen months of arduous research, has finally perfected a fermentation process by which starchy materials (a kind of skilly made from Indian corn or potatoes and water) are converted into fusel oil. The higher alcohols which are separated from this by fractional distillation are converted into isoprene by successive treatments with hydrochloric acid, chlorine and soda lime, and the polymerization is brought about by contact with metallic sodium. This reaction was accidentally discovered by Dr. Matthews, who left some isoprene in contact with metallic sodium in July, 1910, and on returning from a vacation in September found that the isoprene had turned into a solid mass of rubber.

As regards the cost of the new process, while of course at the present stage it is impossible to give any very reliable figures, the preliminary estimates are most encouraging. We are told that the higher alcohols separated from the fusel oil can be obtained at a cost of not more than $150 a ton, and it is expected that the synthetic rubber may be sold at about 60 cents per pound. Inasmuch as para rubber is now selling at $1.35 per pound, the manufacturers of synthetic rubber evidently have every cause to take an optimistic view of their prospects. It would, however, be premature to make any very positive statements with regard to the commercial situation.

It seems fitting that the name of Perkin should be associated with this achievement. Those who are familiar with the history of modern industrial chemistry know that England may well be said to have been its birthplace. It was Sir William, also Perkin, who laid the foundation stone of the edifice of the coal tar industries, which have since been reared to such magnificent proportions chiefly by German chemists and capital. In the synthesis of rubber a close race has been run, in which our English cousins have won, their German competitors coming in as a close second; Prof. Harries's independent discovery of the polymerization of isoprene, though published first, was actually made months later than that of Dr. Matthews.

Engineering

Increase of the Japanese Navy.—We understand that the Minister of Marine in Japan is in favor of the building of 15 dreadnoughts of the largest size, the construction to be spread out over the seven years from 1914 to 1920. Rumor has it that in addition to the four 27,500-ton battle-cruisers now under construction, six other vessels of this class will also be built.

Warship Iceberg Warnings.—The cruiser "Birmingham" is doing good service as an ice patrol on the northern steamship route across the Atlantic. Recently this cruiser sent a radiogram, announcing the presence of three large bergs three miles west of latitude 43.03 and longitude 49.53. It stated that another large berg had been seen fifteen miles to the southwest. The reports are sent to the Navy Department and thence to the Hydrographic Office.

American Shipbuilding.—Last year's shipbuilding, according to the statistics of the Bureau of Navigation, accounted for 1,702 new merchant ships of all descriptions, aggregating 243,792 gross tons, as compared with 1,308 ships of 203,158 gross tons, built during the year preceding. Thirty-five steel vessels were built on the Great Lakes, including two of 8,603 gross tons, the largest vessels in the lake service. Fourteen steel vessels of 30,039 gross tons, were built for the Atlantic service.

Two Battleships a Year.—It is gratifying to notice that the press of the country is supporting the United States Senate in its stand against the House of Representatives in the matter of the increase of our battleship strength. Thus, the Rochester *Times* points out that a programme of two battleships a year will not even enable this country to maintain its relative naval strength, and the San Diego *Union* shows that failure to make the customary addition of two battleships a year must ultimately cause the United States to drop from its present position to that of fourth or fifth among the naval powers.

Steady Rise of Gatun Lake.—We noted recently that two sluice-gates in the spillway dam at Gatun were opened on June 5th, when the lake stood at an elevation of 26.5 feet above sea level. These gates were closed on June 19th, and in the week following the lake had risen to elevation +29.37. The lake may now rise to an elevation +37 feet, 4 inches, at which level it will reach the sills of the guard gates of the upper locks at Gatun. It is expected that these gates, in both the easterly and westerly flight of locks, will be completed and closed before the water reaches the sills, in which case the filling of the lake may proceed continuously throughout the rainy season.

The Ever-present Rail Peril.—H. W. Belknap, Chief Inspector of Safety Appliances of the Interstate Commerce Commission, in his report on the cause of an accident on the Great Northern Railroad on December 30th last, after calling attention to the constantly increasing number of rail failures, due generally to structural defects, says "present specifications and tests, in so far as the detection of longitudinal seams within the rail is concerned, appear to be inadequate. It seems to be time that some definite action were taken toward eliminating this source of danger and securing structurally sound rails." The cause of the accident referred to was, primarily, a defective and seriously seamed 80-pound Bessemer steel rail.

Channel Steamers With Geared Turbines.—The new Channel steamers "Normannia" and "Hantonia," built for the London & Southwestern Railway Company, have been equipped with geared turbines, using a gear of the same general type as the Melville-McAlpin. They show a consumption per shaft horse-power per hour of 1.34 pounds of coal, when the vessels are being run at a maximum speed of 19 to 20 knots. The water consumption for the geared turbines was 12 pounds per horse-power per hour, as compared with 15.1 pounds in similar turbine-driven steamers of about the same size and speed, which use a direct drive. Careful observation in the passenger quarters failed to reveal any inconvenience of vibration or noise due to the mechanical reduction gear.

New Haven Electrical Equipment.—According to Mr. W. S. Murray, Electrical Engineer of the New York, New Haven and Hartford Railroad, the power house for its electrified lines between Stamford and New York has a capacity of 45,000 horse-power for the generation of single-phase current. In 1912, 562 miles of track will be electrified, including tracks in yards and the four-track system from beyond Stamford to New York. The locomotive equipment, including multiple-unit motor-cars, will be 151 units, of a total capacity of 126,800 horse-power. The investment cost of the system, which is single-phase current, will be between 75 per cent and 80 per cent of the cost of an equal direct-current electrification. Mr. Murray claims that the all-day efficiency of his system is 15 per cent higher than that of a direct-current, third-rail system.

Electricity

Sheep Shearing by Electricity.—A novel application of electric power is that of shearing sheep and clipping horses. The apparatus consists of a suitable electric motor connected by a flexible shaft to the ordinary shearing tool. The motor is of the two-speed type, and can be employed also to drive a rotating brush for grooming horses, or a small emery wheel for grinding the clipper combs.

Effect of Light on the Resistance of Selenium.—The effect of light on the resistance of selenium is well known, and has been made the basis of photo-telephonic devices for transmitting sound-waves over a beam of light. It has recently been shown that the changes of conductivity in a certain variety of selenium can be explained by assuming that the light penetrates to some distance into the conducting layer. The effective depth of penetration is about 0.014 millimeters, and filing or sandblasting the selenium surface increases the conductivity.

High-voltage Transmission in England.—A pioneer installation of the Thury direct current series system of electric power transmission in London has been running steadily for about fifteen months. In this system direct current at high voltage is transmitted by two single-conductor paper-insulated underground cables. The circuit is "all-metallic" normally, but in case of breakdown of one of the cables the earth can be used as a return conductor, by permission of the municipal authorities. The cables are, however, designed to carry 100,000 volts, with special precautions against breakdown at the joints. A number of generators in series are used, having an electromotive force not exceeding 5,000 volts each, which is regarded as the limit of safe working on a single commutator.

The Magnetization of Permanent Magnets.—In the course of a lecture at the recent meeting of the British Institution of Electrical Engin... held at Glasgow, Dr. Sylvanus Thompson stated tha... permanence of magnets depended on the quality of ... steel, the shape and dimensions of the magnet, the heat treatment, the maturing, the method of preserving the magnetism ("aging"), and, least important of all, the manner of magnetization. The remanent magnetism of short bars is less than that of long ones: "Short bars have no memory," as Lord Kelvin put it. A good permanent magnet steel should retain an intensity of magnetization of about 1,000 C. G. S. units, and the coercive force increases with the carbon content of the steel. The lecture included a masterly review of the properties of steel as revealed by its microstructure.

Study of Commutation by the Oscillograph.—The oscillograph study of the generation of electromotive force and current in the armature coils of electric generators gives valuable information on the proper setting of brushes, the location of interpoles, etc. A new method of studying commutation by the oscillograph is suggested involving the use of a special armature coil wound in the same slots with the working armature coil which it is desired to study and terminating in slip rings for making contact with the oscillograph circuit. It is proposed to provide an "indicating coil" of this kind, not only on special generators for teaching purposes, but also on all large machines, and on all machines working near the limits of commutation, in the course of the construction of these machines; just as the steam engine builder always provides indicator cocks on his engines.

French Aeroplane Wireless Experiments.—Some very successful experiments were made with wireless telegraphy upon aeroplanes in France at Chartres, using a biplane mounted with the new type of transmitter designed by M. Rouget. The aeroplane started from the aerodrome at Chartres with the inventor on board, piloted by Frantz. In all, a flight of about 100 miles was made, around the country, with 30 miles as the greatest distance from the center. A small wireless post had been put up at the aerodrome and the army officers thus kept in touch with the flyer. The antenna at the ground post was less than 100 feet long and was stretched at a height of 30 feet. The officers could take all the observations made by the pilot *en route* and the signals were quite clear. On the aeroplane the apparatus used an antenna wire about 100 feet in length, hanging down from one end, and the musical spark method was employed. The wireless apparatus, together with a miniature dynamo, weighs but 70 pounds. The small alternator of 200 watts and 110 volts is coupled to the aeroplane motor directly, by means of a new clutch coupler. A small transformer raises the voltage and thus supplies 30,000 volts to the apparatus for charging the condenser. In M. Rouget's new design, all the high tension wiring is localized in a small space so as not to endanger the pilot, as was heretofore found. The transformer is hermetically imbedded in a box with paraffine. The hanging wire of the antenna can be reeled up in 15 seconds. A safety device can cut off the wire should the aeroplane descend very rapidly in case of accident.

Aeronautics

A New Altitude Record.—At the International Aviation Meet held at Vienna, Csakay (the assumed name of Lieut. Miller) reached an altitude of 13,779 feet on June 29th with a passenger. The best previous altitude record with a passenger is that of Prevost at Courcy, 6,858 feet.

A Wright Memorial Prize.—As a memorial to the late Wilbur Wright the Royal Aeronautical Society is soliciting subscriptions for an annual money prize to be awarded for the best lecture on aeronautics. The lectures will be known as the Wilbur Wright Memorial Addresses.

A Nine-hour Zeppelin Trip.—On June 27th the Zeppelin dirigible "Victoria Luise" made a nine-hour trip with twelve passengers directly out from Hamburg over the North Sea. Starting at 6.15 o'clock in the morning, the vessel passed over Helgoland at 9.15. She landed at Hamburg again at 3.15.

The War Department and Aeroplanes.—It is not probable that any advertisements for the purchase of army aeroplanes will be issued in the near future. The policy of the War Department has been to purchase aeroplanes only from American manufacturers whose products are known to be suitable for military service. Orders have already been placed which will obligate all of the available appropriation remaining on hand and no further purchases can be made until the next army appropriation has been passed and approved.

An Accident Due to Air Wash.—During the first aeroplane meeting held at Rheims, in 1909, aviators for the first time realized the dangers of flying in the wake of an aeroplane. Although the perils that lurk in the wash of a flying machine are fully appreciated, nevertheless a serious accident occurred at Villa Coublay, near Paris, on July 5th last. Lieuts Briez and Burlez of the French Army started on a flight to Belfort, each in a monoplane. Lieut. Burloz had attained an altitude of about 600 feet, passing the other man at greater speed, 100 feet higher, forcing a current of air downward and causing the machine driven by Briez to lose his equilibrium. The monoplane crashed to the ground and Briez ... two broken legs, a fractured jaw and injuries to his che... He is expected to recover.

The Dirigible in Warfare.—The *Slampa* of Turin, says the *Times* correspondent of R..., publishes a dispatch from its special correspondent at Bengazi, Count Savorgnan di Brazza, which furnishes an interesting description of the work of a dirigible in actual warfare. The "P1" left its hangar at 6 in the morning carrying on board the Commandante Peuco and the pilots, Capt. Saymandi and Lieut. Benigai. The object was to carry out an offensive reconnaissance, for which purpose the dirigible was supplied with bombs. Rising over the sea to the height of 1,000 meters, it turned eastward toward Koefia, and, passing over that oasis, was able to ascertain that, for the moment, it contained none of the enemy. Making a wide detour, the "P1" turned toward the south in the direction of Sidi Mufta, in the neighborhood of which, both at the foot of the Djebel and on the plain, the principal tents of the Turk and Arab camp lie scattered over a considerable space of ground. No sooner had the edge of the encampment been reached than a number of little puffs of white smoke were observed on the ground beneath, and the unmistakable crackle of rifle fire made itself heard in spite of the noisy roar of the airship's motor. The Turks and Arabs had begun a violent fusillade against the dirigible, which promptly answered by dropping its first bomb. A flash of fire and a dense cloud of smoke rose well in the middle of a group of tents, from which men could be seen hurriedly escaping. A second bomb followed the first, producing the same effect. The Turks, realizing the futility of their rifle fire, brought their artillery into action. From the edge of the sand-dunes two flashes were suddenly seen, followed by others. Evidently the artillery had been prepared beforehand for this purpose, for the shells, instead of bursting low, after following the usual horizontal parabola, took an almost vertical line of flight. Ordinary field guns are not suited to such a use, as they cannot be given the necessary inclination; the Turks had, therefore, posted their guns on the actual slope of the sand hills, burying the tail of the carriage deep in the sand to prevent the overturn of the gun owing to the recoil. This position, while it rendered a nearly vertical fire possible, made the laying of the gun very difficult. In fact, in spite of all the preparations made in advance, the aim of the gunners was wild and their fire quite innocuous. The dirigible, on the other hand, let fall other bombs, which seemed to be as effective as the first. The aeronauts, moreover, while carrying on this aerial combat, which lasted almost an hour, were able to accomplish in the most complete fashion possible the chief end of their voyage—that is to say, an exact reconnaissance of the position of the enemy's camp and estimation of the number of Turks and Arabs that had gathered in front of our lines.

"A Shadow in Court"—The Sequel

By William F. Rigge, S. J.

On February 4th of last year there appeared in this journal an article under the caption "A Shadow in Court" It instanced a case in which the liberty of an accused man hung upon the accuracy with which an astronomer could determine from the position of a shadow the exact time at which a photograph had been taken As the account was written immediately after the first trial, the subsequent history of the case is not without interest. A brief recapitulation of the facts will obviate the necessity of referring to the original number E was arraigned on the charge of having placed with malicious intent a suitcase containing dynamite upon D's porch between 2 and 3 o'clock on the afternoon of Sunday, May 22, 1910 The State produced only two witnesses, girls about 18 years of age, who stated that while walking in the neighborhood shortly before three o'clock, they saw a man answering E's description carrying such a suitcase. The attorney for the defense found upon investigation that the girls at the time were coming from a church a mile away. They had attended services there, and had posed for their photographs twice in front of the building. A prominent shadow in one of the pictures gave the attorney the idea of consulting an astronomer in the hope of finding from the position of this shadow the time at which the exposure had been made The astronomer testified that the time was within one minute of twenty-one and a half minutes after three o'clock. In that case the girls could not possibly have seen the accused at the place and time they averred. This testimony served to split the jury.

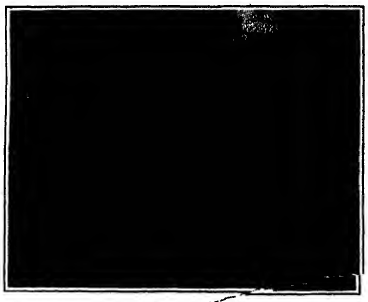
At the second trial substantially the same testimony was advanced as at the first. The attorney for the prosecution, an expert criminal lawyer, realized that his only hope of success lay in invalidating the evidence advanced in the name of science. For this purpose he belittled the calculations and predictions of scientific men generally, and by his sarcasm and witticisms kept the jury in continuous laughter The unanimous verdict of "Guilty" drew a sentence of fifteen years in the penitentiary

The defense then appealed to the Supreme Court of the State. While the sifting of the evidence was in progress, the first anniversary of the taking of the photograph occurred, and it gave the expert an opportunity of verifying his findings. The time he had assigned was in error only a quarter of a minute

Some months later the Supreme Court decided that the accused had been convicted upon insufficient evidence In preparing for a third trial the prosecution called upon G. D. Swezey, professor of astronomy at the University of Nebraska, to remeasure the position of the shadow and recompute the time. Prof Swezey, narrating the event at a public meeting of the Nebraska Academy of Science, held in Lincoln, on May 3d last, said that he studiously refrained from consulting or even referring to any of the former measurements or findings until he had completed his own calculations. The outcome was that he obtained a difference of only twenty nine seconds, thus falling decidedly within the one minute that the defense had allowed as a probable error. The State then abandoned the prosecution

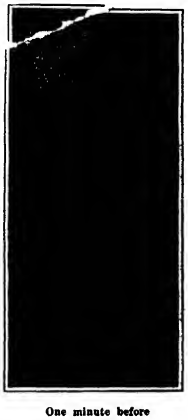
On May 22d last, the second anniversary, the shadow was again on the same spot it covered at the instant the original photograph was taken It will be there each anniversary as long as the building stands and the point that cast the shadow, as well as the wall upon which it fell, remain in their original position

Note that in the first and third pictures the left corner of the shadow is exactly in the middle of a weather board, and that it is below that spot in the second picture and as much above it in the fourth The computed time, therefore, was certainly correct to the minute, and probably so even within a few seconds.

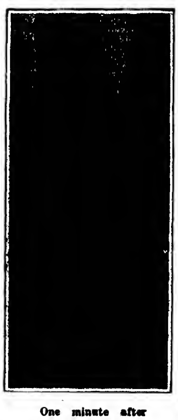


The liberty of an accused man hung upon the shadow at the right.

An astronomer testified that the picture was taken on May 22d at 3 21½



One minute before the computed time.



One minute after the computed time.

Photograph taken at 3:21½, May 22d, 1912, vindicating the astronomer.

Resuscitation from Electrical Shock

By T. Commerford Martin

Of late years, the increased knowledge of electrical phenomena and the riper experience in handling electrical energy, have done much to lessen the number of fatal accidents from electrical shock. On the other hand, the extended introduction of electricity into the arts and industries, the establishment of numerous circuits of high voltage for transmission and distribution purposes, and in general the preference given to the alternating current for a wide variety of work on account of its flexible use over large areas, have brought a much higher degree of risk than obtained under the old regime of direct current of relatively low potential. The net result has been an apparent swelling of the death roll to an abnormal extent, although in proportion to the universalized employment of electricity, the percentage of shock and fatality has doubtless fallen considerably. There are no exact statistics available on this important subject, but in view of the part that electricity plays in modern life, such data might well be increased in some of the inquiries of the United States Bureau of the Census. In 1895, when the present writer was one of its editors, the *Electrical World*, impressed with the necessity for popular instruction on the subject, issued in broad sheet form a chart of instructions to be followed in cases of apparent death from electrical shock; and a revised version of these rules was issued by the same journal in 1902. Without question, the use of these rules for securing resuscitation was successful in a great many instances; and the demand for the charts, circulated gratuitously, became so great, no one can now say how many thousands were printed. They are to this day a prominent feature on the walls of electric power plants throughout the world. It happened, however, that this chart was based on the Sylvester method, directing that the victim of the shock should be laid *on his back*, and his chest expanded and compressed by drawing his arms forward and then pushing them back against his ribs. Serious doubt arose in the course of time as to the real virtue of this method, and meanwhile the Schäfer method attracted attention as probably superior in effectiveness. It consists simply in laying the victim *on his belly*, and then applying pressure rythmically on his loins and lowest ribs. This is known as the "prone pressure" method, and it was soon taken up in Europe, although both there and here the Sylvester method persisted. A crisis was reached about three years ago, the older charts were no longer given out, and it was felt that something must be done to secure unanimity; in doing which the percentage of cases of resuscitation would obviously be raised. When the matter, or the situation, came to the notice of the National Electric Light Association, with its 1,500 private corporations engaged in public service in the United States, to the tune of 100,000 employees, $2,500,000,000 investment and 1,000,000 or more customers, it took the problem up with commendable activity, and at once organized the forces of safety. Two years ago it called into conference the leading engineering societies of the country, the United States Army and Navy, the United States Bureau of Standards, the American Museum of Safety, and the American Medical Association; and the authoritative dealing with the problem was relegated by unanimous vote to the last named powerful organization, the National Electric Light Association and the American Institute of Electrical Engineers. These three bodies selected their representatives as members of a commission, its expenses to be borne entirely by the National Electric Light Association, and then the work was taken seriously in hand. The members are as follows: Dr. W. B. Cannon, chairman, Professor of Physiology, Harvard University, Dr. George W. Crile, Professor of Surgery, Western Reserve University; Dr. Yandell Henderson, Professor of Physiology, Yale University; and Dr. S. J. Meltzer, head of the Department of Physiology and Pharmacology in the Rockefeller Institute of Medical Research—the four from the American Medical Association. Dr. E. A. Spitzka, Director and Professor of General Anatomy, Daniel Baugh Institute of Anatomy, Jefferson Medical College, and Mr. C. L. Eglin, Past-president of the National Electric Light Association—named as representatives of the National Electric Light Association. Dr. A. E. Kennelly, Professor of Electrical Engineering, Harvard University, and Dr. Elihu Thomson, Electrician, General Electric Company—nominated by the American Institute of Electrical Engineers. Mr. W. D. Weaver was elected secretary by the other members of the commission. It is quite needless to point out the distinction and capacity of this able body of men.

Three problems confronted the commission, and in reality only one of them has been disposed of thus far, in the issuance of the new rules, which are based wholly on the Schäfer prone method, approved because of its superior simplicity in application, easy performance by laymen, slight risk of injury to the subject, large ventilation of the lungs, and absence of trouble from the falling of the tongue back into the air passage. The new rules have been issued, both in broad sheet and in vest pocket form, with illustrations of the method. These are copyrighted by the National Electric Light Association to secure integrity of the rules, and are issued at cost, but on request anyone can secure permission, without charge, to reprint in any form, as the commission desires to give the rules the widest vogue and publicity. These documents were formally presented at the National Electric Light Association convention at

(Concluded on page 66.)

The Wirelessly Directed Torpedo

Some New Experiments in an Old Field

By Benjamin F. Missner

IN the year 1897, when wireless telegraphy was in its infancy, Ernest Wilson, an English scientist, was granted a patent on a system for the wireless control of dirigible self-propelled vessels. The primary object of the invention was to provide a weapon for use in naval warfare, which, if in the form of a dirigible torpedo controlled from a shore or ship wireless installation, would be most deadly in its effect on a hostile fleet. Wilson's was the pioneer patent in that branch of radio-telegraphy now commonly called radio-telautomatics. Since then a large number of patents on telautomatics have been taken out by various inventors, and several of those who have been so fortunate as to possess the means, have developed their respective systems in the effort to realize their possibilities.

Gardner of England, Wirth of Germany, Gabet of France, Roberts of Australia, and Tesla, Sims and Edison of the United States during the last ten years have attempted to solve the problem in a practical way. Gardner, Wirth, Gabet and Tesla have used their systems on boats intended primarily for torpedoes, which they control by Hertzian waves. Sims and Edison, with the co-operation of the United States Government, developed a system for controlling a dirigible torpedo through a trailing conductor, and Roberts has applied his system to dirigible balloons. These inventors have had various degrees of success in their endeavor to perfect their inventions, but apparently none has reached the goal. It is true they have controlled the movements of vessels without the aid of wires, but at the best the apparatus worked spasmodically, unsatisfactorily, and the greatest distance at which their vessels were controlled has not exceeded a half mile. But why, we may ask, have these learned men failed to secure the desired results when wireless telegraphy, the mother of radio-telautomatics, has made such wonderful progress?

By analyzing the situation we may find that early in the art potential-operated receiving devices, such as the coherer, which was developed from Branly's tube, were used, which permitted the use of recording mechanisms. As the art progressed new receptive devices were discovered which when used with the most sensitive of all electrical instruments, the telephone, proved the coherer comparatively insensitive and unreliable. Coherers and relays were discarded and replaced by the detectors and telephones, which provided a means of signaling over vastly greater distances with the same amount of transmitting power. The new detectors while forming a very desirable combination with the telephone, were entirely unsuitable for use with relays, and, therefore, those men interested in the control of mechanisms were compelled to retain the coherer as the receiving detector. This is the reason for the poor success attained in the field of radio-telautomatics. The coherer, being spasmodic ("somewhat feminine") in its action, sometimes operates when the transmitting key is pressed, and sometimes operates when no signals are sent, probably steering the boat to starboard when the signal should have sent her to port, or stopping the engine when full speed was desired.

House-boat used to demonstrate the Hammond system of torpedo control.

The coherer has, therefore, been the barrier to the realization of the invention's possibilities.

During the summer of 1911, J. H. Hammond, Jr., a young inventor of Gloucester, Mass., carried on experiments on the control of a dirigible boat, with a considerable degree of success. With no great amount of transmitting power (1.5 kilowatt) and comparatively poor antennae (80 feet and 30 feet, respectively), Mr. Hammond was able to keep the boat under perfect control at distances up to and over a mile.

John Gardner and his dirigible boat.

The boat, which has a displacement of over eight tons and a speed of about five miles per hour, was steered over a prearranged course during both day and night in all conditions of sea and weather. The course was by no means simple, following as it did circles around buoys and a complete circle around the harbor. Fishing and other vessels were continually moving about the harbor, but no great trouble was experienced in avoiding them and at the same time keeping on the prearranged course. It was found possible to steer the boat directly against either of several upright spar buoys a mile from the transmitting station. At night, lights, automatically controlled by the steering mechanisms, kept the "helmsman" at the transmitting key informed of the boat's action. The steering of the boat was accomplished by sending Hertzian wave impulses, which, affecting suitable receiving apparatus and switching devices, controlled an electric motor mechanically connected with the steering wheel. The rudder could, therefore, be made to move to port or starboard, or could be set at any intermediate position at will from the transmitting station.

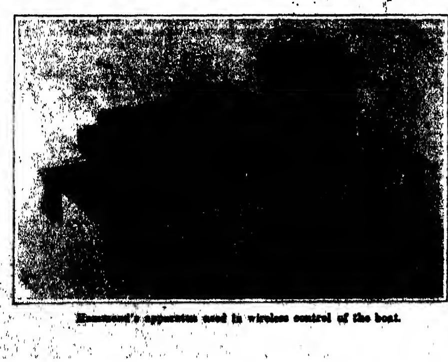
The success of Mr. Hammond's experiments is due largely to the fact that he early realized the unsuitability of the filings coherer, and adopted a more sensitive and reliable type of detector, namely, the mercury-steel disk coherer, which was invented by Sir Oliver Lodge and Dr. Muirhead, and used in their system of syntonic wireless telegraphy. While not entirely satisfactory, the Lodge-Muirhead coherer proved a great advance over the filings coherer, and no difficulty was experienced in operating the sensitive relay used with it at distances up to two miles.

Mr. Hammond, encouraged by last year's work, is building and equipping a large station at Gloucester for further experiments in telautomatics, and with non-interferable systems. Two towers 340 feet high for supporting the aerial wires are being constructed, and eight complete transmitting and five complete receiving sets will be available for use in experimental radio-telegraphy and telephony.

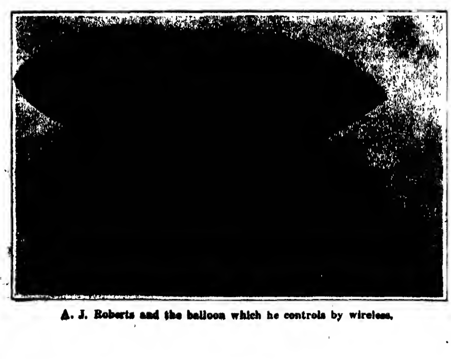
An entirely new receiving detector and a sensitive relay have been developed during the past winter which will greatly increase the range of operation. These instruments, being electrically and mechanically stable, will require no adjustment.

In addition to the wireless equipment, a boat of special design is being built, which will travel at a rate of thirty miles per hour. This boat will be equipped with the wireless control apparatus and will be operated from the station. A 24-inch searchlight and selenium cells of extreme sensitiveness will also be used in controlling the boat, by sending light wave impulses, the wave length of which is of the order of 1/44,000 of an inch in length, instead of or in conjunction with impulses of electro-magnetic waves whose length is of the order of 3,000 feet.

Considering the amount of work that is being done along the lines of torpedo control in the United States and in Europe, and the progress that is being made in radio-telautomatics, it is very probable that the dirigible torpedo will, within a few years, occupy a prominent place as a deadly weapon in naval warfare. It would be absolutely invisible except in the very rare case of an absolutely calm sea.



Hammond's apparatus used in wireless control of the boat.



A. J. Roberts and the balloon which he controls by wireless.

The Business Side of German Science—VIII

Making Money With the Aid of Technically Trained Men

By Waldemar Kaempffert

(Concluded from page 96, July 19th, 1919)

[THIS is the eighth of a series of articles, written by the Managing Editor of the SCIENTIFIC AMERICAN, *on German industrial conditions. The author was sent abroad by the publishers for the express purpose of gathering the material on which the articles are based. In this and the article to follow, the part played by the technically trained man in German business is pictured.*

The amazing industrial development of modern Germany is to be attributed in large part to technical education and to the application of science to business. Capital and science work hand in hand. Every one of the great chemical discoveries of our times, most of them made in Germany, are the result not of haphazard experimenting, but of systematic research that has meant the expenditure of princely sums. All German manufacturing is so thoroughly saturated with science, that even the small producer practises on a miniature scale the methods of his larger rivals.]

The Story of Indigo.

The pertinacity with which a German chemical company will carry on investigations for years, fully convinced that ultimately the goal will be reached, finds no more brilliant example than the development of a commercial process for the manufacture of artificial indigo. In the eighties Prof. von Baeyer of Munich succeeded in producing synthetic indigo—a great achievement. Two of the most powerful chemical firms of the day took up the invention almost immediately. They set chemists and engineers at work. After much time, money, labor and thought had been spent in endeavoring to base an industry on von Baeyer's discovery, it was found impossible to produce indigo in commercial quantities by the means that he had indicated. The firms who backed the invention were discouraged perhaps, but not beaten. When Heumann discovered a method of obtaining synthetic indigo from the phenylglycins, a commercial future for artificial indigo seemed to have dawned. Heumann was practically taken into partnership with capitalists who recognized the immense possibilities that lay in his discovery. Without them he would have been able to do nothing. Seven years of hard work elapsed before the first indigo could be manufactured by Heumann's process for the market.

It pays to spend money and time so lavishly. The amount of indigo manufactured to-day would require the cultivation on an area of more than one-quarter of a million of acres of land in the home of the indigo plant. As late as 1897 thirteen million pounds of indigo were grown, valued at twenty million dollars. Not more than one-sixth of this quantity of natural indigo is now marketed. The Calcutta harvest for example, in 1896 amounted to 158,922 maunds and in 1909 to only 81,200 maunds, a maund being 82.14 pounds. In Java, in 1898, there were 122 indigo plantations; in a few years they were reduced to 28. A harvest which in Java amounted to 12,580 boxes in 1898 was reduced to 2,015 in 1908. In 1897 Germany imported $3,200,000 worth of natural indigo, in 1909 only $160,000 worth. On the other hand the export of synthetic indigo in Germany amounted to nearly $2,000,000.

The same story is repeated in the history of alizarin. In 1868 France exported about $600,000 worth of madder. To-day madder is almost unused. Instead, millions of pounds of artificial alizarin are manufactured, seven-eighths of the entire output in Germany. In 1892, 320,000 pounds of cochineal were used in Germany. In 1897 the use of cochineal had dropped to about 34,000 pounds.

Reducing the Cost of Old Processes.

The men in the research laboratories of German manufacturing companies are concerned not only with the discovery of new compounds and the inventing of new apparatus, but also with the simplification and the cheapening of old and long established processes. There has been a vast improvement, for example, in the manufacture of salicylic acid, of which one hundred and twenty-nine tons were exported from the German Empire in 1882, and five hundred and two tons in 1905. Although in twenty years the amount exported increased four times, the price of the acid dropped to one-sixth of what it was originally. In 1900, again, anti-febrin was worth about seven and one-half times what it brought in 1905. Vanillin, which has taken the place of vanilla extract, and which has been produced artificially for the last thirty years, was worth about $1,800 a pound in 1876; in 1902 it was worth about $8 a pound. These remarkable reductions in the selling price are to be attributed entirely to simplified methods of manufacture. The result of the cheapening has been the opening of a much larger market than could otherwise be supplied.

In the dyestuff industry the advances which have been made in the last decade in thus improving original processes is perhaps more marked than in any other phase of German manufacturing. Most of the improvements have resulted in securing a greater degree of fastness to washing, light and similar agencies. Thus, in dyeing cotton the want of fastness of the earlier "salt" dyestuffs soon led to attempts to fix the colors after dyeing. One result of these many attempts was the introduction in 1894 of Vidal black. Immediately a wonderful development of "sulphide" dyestuffs followed. The cotton dyer obtained cheap dyes of much greater fastness than those of the old "salt" class, which, therefore, were gradually displaced. Sooner or later the sulphide dyestuffs will have to give way to the newer vat dyes of the anthracene and indigoid classes when they have been cheapened sufficiently.

Sometimes the discovery of a new process may lead a rival manufacturer to begin a systematic study of an old process in order to improve and cheapen it to such an extent that it will not be crowded out of existence. An example is to be found in the making of sulphuric acid. When the Badische Company devised a method of making sulphuric acid commercially by the contact process it seemed as if the old lead-chamber was doomed. But the story of the competition between the electric light and the gas light was repeated; a method was found of improving the old lead-chamber process and increasing its efficiency, so that it is still worked side by side with the contact process.

Testing New Products Before Marketing Them.

The introduction of a new dye, a new drug, a new explosive, and new fabric is not conducted in a haphazard way. Business men the world over realize that there is an ethical side to the selling of goods. The old days when a salesman was simply a hired liar who stopped at nothing in selling his goods are over. A modern manufacturer not only refuses to misrepresent his products, but he will not even market them if they are not at least as good as the old.

In connection with every research department in Germany will be found a testing laboratory—a place where a newly discovered product must prove its worth. A new dyestuff is subjected to hundreds of practical tests before the public ever hears of it. It is tested for fastness by exposing it to the sunlight by ascertaining how it withstands ordinary alkalis and much washing, and by noting its effect on leather, paper and fabrics in general. As a result of hundreds of tests it may be revealed that a new chemical product is not as good as an old one, or that it is injurious in some way. Despite the fortune that may have been spent in devising a process for its manufacture, it is cast aside immediately.

The introduction of new drugs and medicaments imposes this moral obligation to a high degree. At Hoechst will be found perhaps the largest works in the world for the production of medicines and chemicals that are used in the ordinary physician's practice. Here will be found remarkable laboratories for testing the qualifications of a new virus, serum, drug, or narcotic which is to be used in curing human ills. The laboratory physician works hand in hand with the chemist; the physiologist with the physicist. No bacteriological laboratory, no hospital is conducted with more scrupulous care. A fine stud of thoroughbred horses, from three to eight years old, are an indispensable aid in supplying sera and anti-toxins. The therapeutic agents discovered are rigidly controlled partly in the Institute for Experimental Therapeutics of Frankfurt, partly at Hoechst itself. Diphtheria serum, anti-dysentery serum, anti-pneumococci serum, anti-streptococci serum, scarlet streptococci serum, tetanus serum, Robert Koch's tuberculin preparation, as well as Ehrich's salvarsan are here prepared and carefully tested before they are sent out.

Analysis of Raw Material.

No longer is raw material bought simply by quantity and with only the most superficial regard for quality. Mass production is the reason. When the output of a steel mill or a sugar factory is millions of tons a year, it pays to save a cent a ton on raw material; it pays to determine beforehand and exactly how much of the raw material can be utilized to produce a certain amount of goods. The old-fashioned miller for example used to thrust his hands into the grain that he bought in order to feel its moisture; or he would grind it between his teeth. It is perfectly obvious that by such crude methods he could not determine differences in moisture of one or two per cent; yet such extremely slight differences may be of untold importance in modern milling. Grain is sold by weight. If it contains a large percentage of water, the miller is simply buying moisture which easily evaporates. Hence, we find that the modern miller—and particularly the modern German miller—scientifically analyzes the grain that is offered to him. Not only does that analysis govern the price to be paid for the grain, but it determines its keeping qualities. When grain is to be stored for a long time, it is not a matter of indifference whether it contains fourteen per cent or sixteen per cent of water. Experience has shown that wheat containing as much as fifteen per cent will keep for a long time, whereas wheat containing only sixteen per cent—only one per cent more—may suffer.

Only a very wealthy firm, it may be argued, can afford to pay a scientifically trained man to test raw materials in this way. That is true enough. But the small firm in Germany proceeds scientifically nevertheless. Much valuable technical assistance is given by manufacturing firms to small consumers of their products who are not able to engage a chemist or a technically trained man regularly. Thus the firm of Simon, Bühler und Baumann of Frankfurt employs a chemist whose chief duty it is to assist breweries and millers to reduce their cost of manufacture by analyzing raw material and waste products, and submitting the results of his examination. Moreover, there are dozens of consulting technologists whose services may be engaged for no very large sum.

The Sociological Side of German Industry.

There is a sociological aspect to German industrial science which is obscured by a national prosperity expressed in exports that amount to millions and millions of marks a year. Each new coal tar drug that is unearthed, each new method that is discovered for the utilization of waste material, means work. It is no small task to provide places for one-third of a million human beings, who annually demand a chance to earn their living. The fact that there is so little poverty in Germany, that a task is provided for every able-bodied man, is due in large measure to the laboratory scientists in the employ of the huge manufacturing companies.

Macquarie Island

PUBLIC attention has recently been directed to Macquarie Island, owing to the fact that the Mawson Antarctic expedition, on its way south, established a wireless telegraph station here, so that the island is now in daily communication with Hobart, Tasmania. It was hoped that this station would be able to relay messages to a wireless station at Adelie Land, the base of the expedition on the Antarctic continent, but this plan has proved impracticable. It is said that magnetic disturbances due to the proximity of the south magnetic pole make communication between these two points impossible. However, the Macquarie Island station has proved of some value to shipping in Australian waters by giving timely notice of storms coming up from the south.

Macquarie Island, which belongs to Tasmania, is about 750 miles southeast of Hobart, and is, therefore, a halfway point for expeditions proceeding to the Antarctic on the Australian side. It was visited by the expeditions of Scott and Shackleton, as well as by Dr. Mawson's party. The island is about 22 miles long by 5 broad, and has a rugged coastline, rising sheer out of the water to a height of 1,500 feet in places.

According to a recent consular report this island has been leased by the Tasmanian government to Mr. Joseph Hatch, who has established here the lucrative business of catching penguins for their oil; probably the most southerly industry of the world, except certain fisheries. It is said that there are 80,000,000 penguins on the island. The oil is obtained by boiling the carcasses in digesters capable of dealing with 800 birds at a time. The product is barreled and sold to binder-twine makers in Australia and New Zealand. The chief obstacle to the success of this enterprise is the fact that the island has no harbor. Vessels have to lie about half a mile offshore, and all material is conveyed to and fro on rafts made of casks. Several ships have been wrecked in attempting to visit the island.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Stress in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

Apropos of your recent editorial on the stress in aeroplanes, I note that the values in my table in the SCIENTIFIC AMERICAN of August 26th, 1911, have to be multiplied by 22/15 to make them correct. The abstract formula used in computing those values is right, but by an oversight the factor 22/15 was omitted from the arithmetical computation. All the more, therefore, the warning in your editorial appears to be well founded.

A. F. ZAHM.

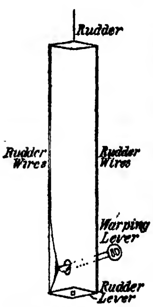
Cosmos Club, Washington, D. C.

An Explanation of the Quimby Accident

To the Editor of the SCIENTIFIC AMERICAN:

As manager of the aviation meeting at which Mr. Willard and Miss Quimby came to a violent end, I had unusual facilities for making prompt examination of the wreckage and I wish to make the following report in the hope that all monoplane constructors will avoid such a defect in construction as existed in Miss Quimby's Blériot monoplane.

Referring to the rough sketch which I inclose, which is a plan view of the machine upside down as it rested in the water, I found that one of the two left-hand control wires (all of the Blériot control wires are in duplicate) had caught over the lower end of the warping lever. Of course this is a defect in construction as the rudder wires should either have been put farther away from this warping lever, or else been run through guides at this point so as to prevent them becoming entangled with it.



Plan view—upside down.

The reason this has not happened before in a Blériot monoplane is because the warping lever, as used in Miss Quimby's machine, was not the conventional Bleriot "cloche" which was a feature of my 70 horse-power monoplane, and all others I have ever seen. I noticed this departure from conventional Blériot practise when I examined Miss Quimby's machine before the flight. I have also called the matter to Monsieur Blériot's attention in a letter under this date.

It is some satisfaction to know definitely the cause of this accident and I assure you that I hardly think there is a chance of my being mistaken. I was the first one to examine the wreck and this rudder wire was caught over the control lever when I looked at the machine. And from what happened in the air, for I saw the whole accident, I am convinced that this was the difficulty. At any rate, the construction should not have been such that this wire could possibly have been looped over the control lever whether in the air or at any other time. It is too bad that all aeroplane accidents do not leave such a clear record of their cause.

EARLE L. OVINGTON.

Newton Highlands, Mass.

[We have had an interview with Miss Quimby's mechanic, and the following is his version of the accident:

Miss Quimby had returned from her flight to the Boston Light and had made one big circle over the field, at a speed of 70 to 80 miles an hour. She was flying without banking the machine, which was unnecessary on account of the size of the circle she was describing. At the beginning of the second round the mechanic saw Mr. Willard fall out. Relieved of his weight, the machine instantly dived at an angle of about 60 degrees. Miss Quimby succeeded in partially righting it before she, too, was flung out. The machine glided down at an angle of not more than 30 degrees, struck the water, and turned over. The mechanic examined the wreck of the machine almost immediately, and found everything intact about the controls. He states that there was no fouling of the rudder wires by the control post, that, indeed, this was an impossibility because there was a clearance of at least four inches between the end of the post and the rudder wires when the post was moved as far as possible to the right or to the left. It is difficult to reconcile the mechanic's explanation with that of Mr. Ovington. Hence, we publish both accounts, suggesting that the true cause of the accident will probably never be known. The mechanic's explanation of how the accident happened starts with the loss of the passenger, who, he believes, may have become ill and have stood up in an endeavor to signal to Miss Quimby to descend. It is possible that the machine was skidding sideways slightly and that Willard fell over the side. The mechanic did not see just how he fell, but saw everything that happened afterward. Miss Quimby's arms were broken and her chest crushed in, evidently from her being thrown forward with great violence on the curved hood when the machine made a sudden dive. Consequently, she could not right the machine, even if it were possible when once the passenger was gone. Miss Quimby had never experienced any difficulty in controlling her powerful Blériot. That she could manage it perfectly was shown by the fact that she alighted and started on a strip of ground only 100 feet wide during her flights at Boston. From all this it would appear that the machine had a fatal defect in becoming unbalanced as soon as the passenger was thrown out. Without a passenger or pilot, however, it seems to have been perfectly balanced and to have glided safely to earth.—EDITOR.]

Mississippi River Levees

To the Editor of the SCIENTIFIC AMERICAN:

The levees or dikes of the Mississippi River continue giving way, thus proving by practical demonstration the futility of the earthen dike system now in vogue along its banks for protection against overflow. The Government as well as individuals has sustained irreparable loss this season from the innumerable crevasses caused by the record-breaking flood height. It would be a conservative estimate to place the value of the standing levees along the Mississippi at $50,000,000. This is for levees now standing that have successfully weathered this season's flood, it would not include millions of dollars spent in years gone by for levees washed away, fallen in, etc.

There is now a strong movement on foot by the different States, petitioning Congress to take over to Government care the building and maintenance of these dikes. No doubt Congress will do the right thing particularly as it is in line with the administration policy.

By way of economy to conserve the fifty million dollars of dikes now standing, it would not be a bad idea to sheet pile directly through the center of the crown. Tongue and groove piling such as "Sewall" or "Wakefield" would answer admirably, particularly if the timber was creosoted, thus insuring an unlimited life; this would present a powerful barrier and be absolute proof against the ravages of musk-rats, cray-fish and king-fishers. The piles should extend from the top of the levee down into the original ground fully 10 feet. In localities where cypress timber is obtainable, the piles could be made of that wood which would last indefinitely underground, without treatment, and be a saving of nearly 50 per cent over creosoted timber. This work, using cypress, ought not to cost more than $5 per foot, in place.

New Orleans, La. C. JULIAN BARTLETT, C. E.

Successive Passages of the Sun Through the Equinox

To the Editor of the SCIENTIFIC AMERICAN:

To the inquiry of Mr. John Ford, appearing in your issue of May 25th, I have to say that in the issue of March 2nd, the interval between successive passages of the sun through the equinox (365 days, 5 hours, 48 minutes, and 46 seconds, according to Mr. Fox) is given as 365 days, 5 hours, and 49 minutes, and that my figuring was done accordingly, but I failed to take into consideration that a leap year is added every 400 years. Further, in figuring out the editor's answer, I discovered that my statement, "at the end of each century we are still short 344 minutes," should have been 384 *minutes* (1,440 less 1,056) an error which was probably overlooked both by the editor and Mr. Ford.

After going over Mr. Ford's figures I find them correct, and thank him for having called my attention to the subject.

WILLIAM FALBE.

Mayaguez, Porto Rico.

A Card Trick

To the Editor of the SCIENTIFIC AMERICAN:

The following card trick was explained to me during a recent railroad journey, and I was told that so far as the party knew, it had not been published. It is called the "Hawaiian Islands," and the little story was told as the cards were laid out in playing the trick. The story ran something like this:

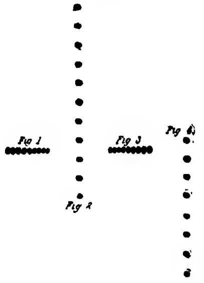
There were four islands in the sea (and the four aces were laid out for the islands) and on these islands there were diamonds (four diamonds being placed one on each ace) and four kings went to get the diamonds on these islands (putting the four kings on the four diamonds) and these kings had nothing to dig with but spades (four spades being laid out, one on each pile) and four pirates went to rob the kings of the diamonds (the four jacks being laid out on the piles) and these pirates had no weapons but clubs (four clubs being placed out on the piles) and four queens went to save their kings from the pirates (the four queens being placed one on each pile) and these four queens had nothing to take with them but their hearts (four hearts being laid one on each pile). When the cards are so laid out we have four piles beginning with an ace below and including each an ace, a diamond, a king, a spade, a jack, a club, a queen, and a heart. Now place these four piles one upon another into a single pile or pack. This pack may now be cut, by a square cut, no double cuts allowed, and it may be cut as many times as desired by the party to whom the trick is being exhibited. Then after the party has cut as many times as desired, take the pack and put the cards out in eight piles, taking them in order and going back to the first pile from the end of the eight in regular order through the eight piles, and it will be found that all four aces will be in one of the eight piles, all four kings in another, all four queens in another, and so on throughout the series of eight. It may add to the interest of the trick for the party playing it to insist on the right of making at least two cuts after the other party has cut to his heart's desire. The trick is absolutely certain in its results when properly played, and it makes no difference whether the party cuts once or a thousand times, if the cut is always a square cut. He may cut deep or shallow as he pleases, and the result is not changed.

REGULAR READER.

Where Do the Secondary Images Come From?

To the Editor of the SCIENTIFIC AMERICAN:

I have observed that when light from a bright source, for example, an electric light, falls on a plate glass mirror at a very large angle of incidence—as near as possible to 90 degrees—a number of images become visible in the mirror. At first I supposed this was due to multiple



Variations produced by rotating the glass.

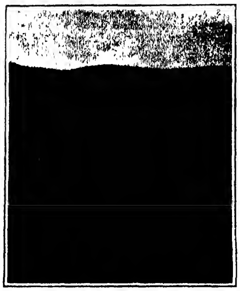
reflection from the two faces of the glass, but I have difficulty in accounting for the different positions of the images. If the glass is kept in the same position but rotated about an axis perpendicular to the plane of the mirror, the brightest image, which is the second one in the series if a silvered mirror is used, seems to remain in about the same position, but the secondary images move around the bright one.

When the glass is held in one position, the images appear as in Fig. 1. When the glass is rotated through 90 degrees, the images move to the positions shown in Fig. 2. Another 90 degree rotation gives Fig. 3, and so on. In Figs. 2 and 4 the secondary images appear to be about as far from the eye as the primary, but in Figs. 1 and 3 I believe they are unequally distant from the eye, although it was very difficult for me to determine whether the primary or secondary images were the nearer. I thought that perhaps in Fig. 1 the secondary images were nearer and in Fig. 3 they were farther from the eye than the primary, or *vice versa*. If this is true, it would indicate that the secondary images were rotating in a circle or ellipse the plane of which is nearly perpendicular to the plane of the mirror but oblique to the reflected ray along which, of course, the eye is looking.

The light giving the secondary images after the first three or four is plane polarized, as was shown by examining it with a Nicol prism. I suppose this might be accounted for by the several reflections which it has undergone, but why should the secondary images change their location while the mirror merely rotates in its own plane?

It occurred to me that the glass might be double refracting and the secondary images due to the extraordinary ray, but this does not seem very clear to me. If this is the true explanation, the question at once comes up as to what becomes of the ordinary ray. The plane of polarization does not rotate as the secondary images move around the primary.

Emporia, Kans. W. B. LEWIS.



The ruins of Samaria, looking west.

Recent Excavations at Samaria

Discovery of the Palace of Ahab

Herod's Buildings Unearthed and Ancient Jewish Inscriptions Found

By Harold J. Shepstone

Idols from Samaria.

ONE of the most interesting and valuable discoveries so far recorded in the field of Biblical archæology has been the recent unearthing at Samaria, in Northern Palestine, of the palace of a Hebrew king, believed to be the "ivory house" of Ahab. Labels with Hebrew writing, which seem to have been in actual use during the life time and perhaps in the households of Omri and Ahab, have also been found, as well as many fragments of pottery. Many Biblical names appear in the writings, such as Elisha, Asa, Nathan, Uzza, Sheba, and Abiezer.

Samaria was the ancient capital of the Northern Kingdom of Israel. When Solomon died, about 930 B.C., his kingdom broke into its two natural hereditary divisions, Israel and Judah. Shechem, the first capital of Israel, lying in a narrow valley and therefore difficult to defend, was abandoned for Tirzah. This in its turn, about 875, was given up for a new site. Omri, founder of the third dynasty of Israel, chose for his capital an isolated hill some six miles northwest of Shechem. The city which he built here he called Shomeron, now best known by the later Greek form of the name, Samaria.

The hill rises to a height of 400 to 500 feet above the valleys which surround it. From the summit, some 1,400 feet above sea-level, one may see the Mediterranean, on clear days, some twenty miles to the west. There are also fine views into higher mountains on the north and east, and over the hills and valleys south and west. The naturally steep sides of the hill were easily rendered impregnable by massive walls. The Herodian city, occupying the top of the hill, was about two and a quarter miles in circumference, and the city of Omri was perhaps not much smaller. The Herodian wall can still be easily traced. There is no fountain on the hill, and the people of the city must have been dependent on a spring across the valley and on rainwater stored in cisterns, of which a great many have been recently unearthed. The hill and the country around are fertile, producing good crops of olives and figs, grain and onions, and in antiquity, grapes also. For agricultural purposes the hill and those about it have been heavily terraced, a work which has greatly disturbed and confused the ancient débris.

Samaria remained the capital of Israel till taken by the Assyrians in 722. Here Ahab, under Jezebel's influence, built a temple to Baal, later destroyed by Jehu, and here it seems he built also his "ivory house" or palace, described in the First Book of Kings. Then it was in Samaria that Elisha had his home. The city underwent many vicissitudes while under Assyrian and Babylonian rule. It reached its highest artistic glory, however, under Herod the Great, who rebuilt it in great splendor and named it Sebaste or Sebustyeh (Latin, Augusta) in honor of his imperial patron, Augustus. Sebustyeh is still the name of the village on the eastern slope of the hill. Herod fortified the place, and built a great temple here in honor of Augustus.

This, briefly, is the history of the site of the recent excavations which have been most fruitful of result. They were undertaken by the Harvard University. The only condition which the Turkish Government insisted upon was that the place be left just as it was before the excavations. This compelled the explorers to do their digging in sections, the earth from each fresh section uncovered being used to bury again that already laid bare after it was minutely examined and fully and accurately planned. Hence it follows that of the very extensive work of uncovering done, first under the direction of Prof. Lyon of Harvard, and later under that of Dr. Reisner, well known in connection with similar work in Egypt, only comparatively limited portions can now be shown by photographs.

The most extensive and the most interesting work done was that on the summit of the hill. Here sometimes as many as four hundred men, women and boys, including gangs of experienced workers from Egypt, were employed at one time, and here, by long continued and indefatigable toil, the rubbish of successive generations, civilizations and conquests was removed, for a depth of many feet, until the bed rock was reached, which disclosed, almost without a doubt, the extensive palace of Omri and Ahab, covering an area of nearly two acres. The lower courses of the masonry which came in contact with the rock showed the same peculiarity as was discovered when, nearly a generation ago, the wall of the Temple inclosure in Jerusalem was laid bare to its foundations, eighty feet below the present surface. The first course of stone in the temple was embedded in the living rock, in such a way that that layer had rock on all three sides of it, which seems a distinctively Jewish feature. It was at this level in the excavations at Samaria that an alabaster vase, with the Egyptian inscription of their contemporary king, Osorkon II., was found, confirming the assumption that this was the palace of the Jewish kings.

Here it may be noted that this is the first and only palace of a Hebrew king ever found, and accordingly is unique and of the deepest interest to archæologists and Biblical scholars. It was undoubtedly an immense building, consisting of chambers grouped around courts. Here and there stand portions of the finished wall to a height of several courses of stone. Moreover, two grades of construction appear, a coarser and a finer. The explorers suggest that we have here the palace of Omri enlarged in a superior style by his son Ahab.

There were also discovered here some seventy-five fragments of pottery inscribed with records or memoranda in the ancient Hebrew script. This is not the comparatively modern square Hebrew character with which most persons are familiar, but that ancient writing, closely allied to the Phoenician, which is found on the Moabite Stone and the Siloam Tunnel Inscription. The character of these inscriptions has settled one disputed point about that of the Siloam. It shows that it could easily have been written in the time of Hezekiah, as it purports to be, for here is writing of the same type used at Samaria more than a century and a half earlier, for Ahab lived in 896 B. C. and Hezekiah in 727. These inscriptions are written in ink with a reed pen, in a flowing hand, proving that this was the common form of writing at that period. The words are evenly divided from one another by dots or strokes, making it much easier to decipher them. It is evident that the inscriptions were written upon jars of wine and oil, and even a date is added, evidently the year of the king's reign. The owner's name is given, as well as the person or place whence the oil or wine came.

Here are some of the inscriptions, proving how exact the ancient scribes were in their methods:

"In the tenth year. For (or belonging to) Shemaryo. From the Tell. A jar of fine oil.

"In the ninth year. From Shaphtan. For Ba'alzamar. A jar of old wine.

"In the eleventh year. From Shemida For Heles, Aphsah, Baala (and) Zeker.

"In the tenth year. Wine of the vineyard of the Tell With a jar of fine oil."

These jars were evidently stored for their owners, but where no owner is mentioned the wine probably belongs to the king's palace. It will be noticed that in some of the inscriptions the "Tell" or "Vineyard of the Tell" is mentioned. It is evident that this vineyard must have been one that was especially well known. No vineyard in all history was so well known as the "Vineyard of Naboth," and it gained its fame in the reign of King Ahab.

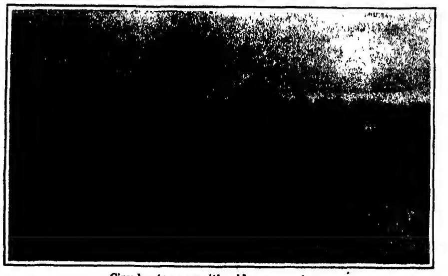
The excavations on the summit showed four superimposed eras of structures—Jewish, Babylonian, Greek, and Herodian or Roman—in one case, as it were, preserving within the inclosure of the larger building of later date the core of the older edifices. Of the Roman remains found the most imposing was the 80-foot wide staircase leading down to an altar and probable temple, put up in honor of the Emperor Augustus, where was also found the huge marble trunk of a Roman statue, lying headless and without arms or limbs, which was in all probability that of Cæsar. The crate containing this relic can be seen in one of our photographs at the foot of the great staircase

Besides the remains just mentioned found on the summit of the hill there was uncovered on the east side of the hill, near the native village of Sebustyeh, the large Roman basilica, the largest and most perfect of the buildings unearthed here, with its tribune, in semicircular form, still intact, into which later Arab masonry was fitted, and below which earlier remains of places of worship could be inspected. Some work was also done in the triple colonnade, scores of whose monolith columns are seen, some erect and some prone, and all without their capitals, along the brow of the hill, which colonnade led from the tower-flanked western gate of the city to the forum and basilica on the east. Beside this the city wall was traced all round the hill, showing that it was a larger city than the present Jerusalem within the walls.

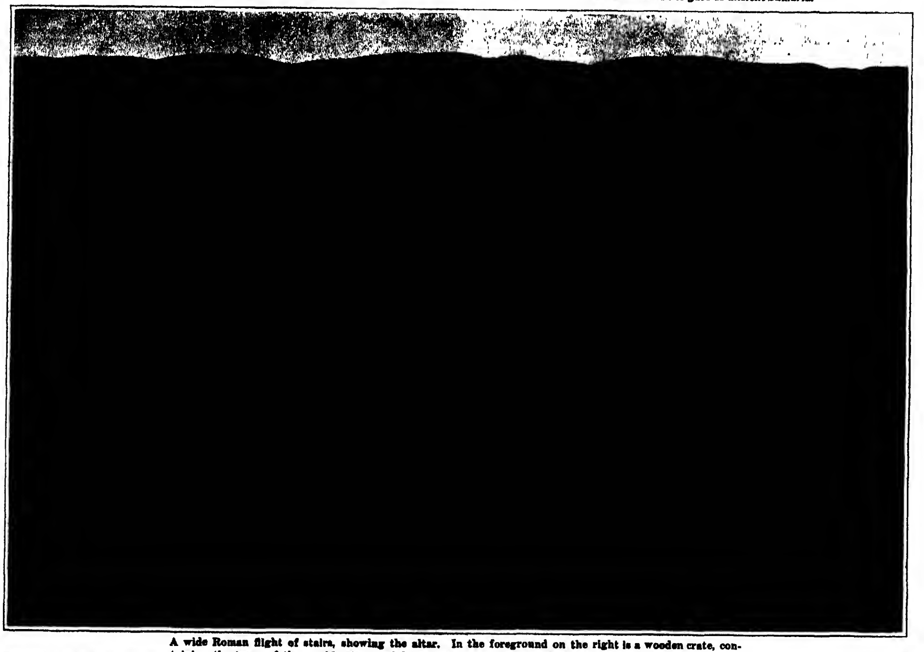
The work around the city gate on the west proved particularly interesting, for this gate has generally been connected with the story of the lepers at the time of the three years' siege by the Syrians, who, on going to the camp of the enemy rather than starve before the city gate, found it deserted, and bringing the news to the famished inhabitants, brought about the fulfilment of the saying of the man of God that on the morrow a measure of fine flour should be sold for a shekel and two measures of barley for a shekel, and that though the disbelieving officer of the king should see it, yet should he not taste of it, it transpiring that he was trodden under the feet of the eager and hungry citizens surging through the gate. Here Roman, Greek and Hebrew remains were found superimposed one on the other, betraying, among much else, this peculiarity, that whereas the towers were constructed so that they led east by north to the royal palace, yet when the Romans reared their magnificent colonnade, the angle of the gate was altered, being turned to the south so as to lead through their new covered street, lined with stately columns, to the Roman tribunal.

It is Dr. Reisner's intention to resume the work of excavation during the coming summer. Only a small portion of the mound has so far been explored. It is thought by many that here may be hidden valuable documents telling of the life and history of the early Jewish kings. Then it must not be forgotten that the age of Ahab is only a century away from that of David. The division of the land of Palestine into two kingdoms—one with Jerusalem as the capital and the other with Samaria as the capital—occurred only fifty-six years before the time of Ahab. Solomon and all his glories were still fresh in the memory of those still alive, and any part of the literature of this important period may be discovered when the rest of the mound of Samaria is excavated. That there are certainly some documents on clay, if not on papyrus, is indicated by the finding of a piece of the clay envelope of an Assyrian letter, with a part of the name of the man to whom it was addressed still there. The finding of even a fragment like this indicates the great probability that in the mound may be a great mass of these letters, in fact, all the records of the Northern Kingdom of Israel, for the Assyrian language was used at that time in correspondence between Palestine and Egypt, as has been proved by the Tel-el-Amarna letters discovered in Egypt a few years ago. Such letters would parallel the Biblical narrative.

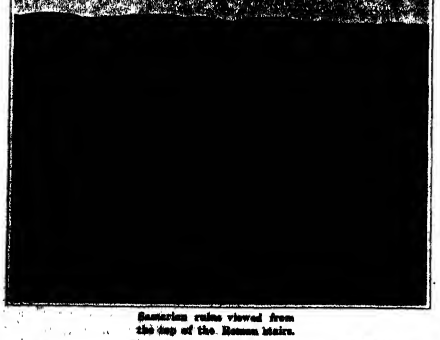
Row of ancient columns of the Herodian colonnade among the ruins of Samaria.



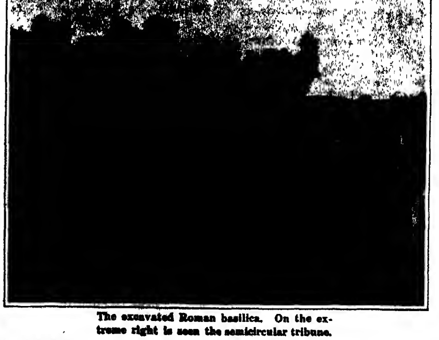
Circular towers, with older square base, which flanked the gate of ancient Samaria.



A wide Roman flight of stairs, showing the altar. In the foreground on the right is a wooden crate, containing the torso of the marble statue of Cæsar which was found in the early stages of the excavations.



Samarian ruins viewed from the top of the Roman stairs.



The excavated Roman basilica. On the extreme right is seen the semicircular tribune.

RECENT EXCAVATIONS AT SAMARIA

Handcuff Releases Under Difficulties

The Remarkable Feats of Harry Houdini

AMONG the well known vaudeville entertainers must be mentioned Mr Harry Houdini whose celebrated feats with handcuffs strait jackets and various restraints used to confine the insane and criminals are well known The public always seems to be interested in seeing the other fellow get away from a tight place so that it is little wonder that Houdini's audiences are always large Our attention has recently been attracted to a number of feats which he has been performing in New York and other cities the culmination of which perhaps is the aquatic box trick which we will now describe

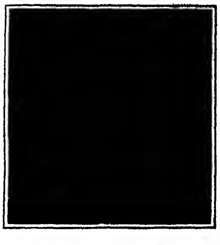
On Sunday July 7th Mr Houdini invited a party of newspaper men and those interested in magic to witness a very remarkable box trick on New York Bay This event was scheduled to take place at a pier on the East River but owing to police interference the scene of operations was transferred to the deck of a large lighter which was towed to the dock of the Quartermaster's Department at Governor's Island As this was Federal property the police could not interfere with this act

A large wooden box 40 inches long 22 inches wide and 24 inches high was provided This box was carefully examined and no indication of panels bolts or springs was detected After divesting himself of his outer clothing and after a committee had seen that he did not have any concealed keys or devices for picking the locks of the handcuffs he submitted cheerfully to be manacled with leg irons two pairs of handcuffs and elbow irons Any of the spectators had the privilege of bringing their own handcuffs if they so desired as Houdini does not care about furnishing articles of this kind when he is making his more important tests The cover of the box was removed and Houdini crouched in it in a stooped position somewhat resembling the doubling up of a jack knife The cover was then nailed in place with thirty six wire nails and the entire box was banded with band iron or as it is technically known packed for export On each side a length of iron sewer pipe was secured and iron sash weights were introduced into the pipe thus affording a convenient method of weighing down the box so as to cause it to sink to the level of the water Two hundred pounds of iron was used Holes had been bored in it to permit the entrance of the water so that the box itself could be readily submerged The box was then carefully roped so that no escape from it could have been possible had the nails and band irons been non-existent or have given away Some of the planks from the lighter were removed and the box was shoved out on them and was finally dumped in the water In exactly a minute and ten seconds Houdini emerged from the water swimming toward the lifeboat which had been provided The act was witnessed by thousands of spectators who crowded the decks of three ferryboats The box was hauled onto the deck with the aid of one of the spars of the lighter and the box was carefully examined Nothing was found in it except the useless manacles which had failed to bind Houdini under the most adverse conditions Considering the danger of this feat and the entire absence of any paraphernalia such as traps etc it appears to be all the more wonderful This may be regarded as one of the most remarkable tricks ever performed and it is only regrettable that a feat of this magnitude cannot be tried before a larger gathering of spectators

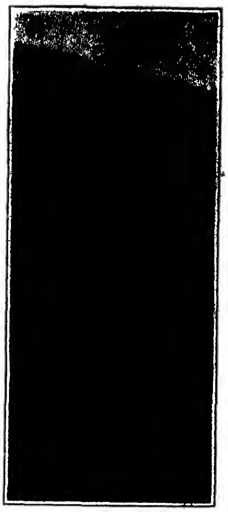
Houdini's box tricks, his milk can trick and similar entertaining feats will not appeal to the average person as much as his bridge dives which have taken place in all parts of the world. We are able to show two or three photographs which give an adequate idea of the remarkable nature of a feat of this kind. In one of the engravings we see Houdini with his hands manacled behind his back and his arms also confined by elbow irons. This photograph was taken just before an 80-foot jump at Sydney, Australia. The next photograph shows the agonized face of Houdini after he struck the water at the wrong angle. Blood flowed from his nose and mouth. This goes to show that the career of the professional strong man, jail breaker and handcuff king has not been altogether unfraught with danger Several of his imitators have tried similar feats with disastrous results, such as broken ribs, and even two of them paid the penalty with their lives, being drowned with the manacles still on their wrists Owing to the uncertainty of an act of this kind if unsuccessful it would be almost impossible to rescue and resuscitate a person before he is drowned.

A third photograph shows the position of Houdini's body in his famous jump from the Queen's Bridge, Melbourne, Australia, in March, 1910 His hands were heavily ironed behind his back with handcuffs and he succeeded in reaching the surface in a surprisingly short space of time In this case he was under water about two minutes. A gruesome incident occurred at the time of this dive The shock of Mr Houdini striking the water was great enough to bring to the surface the body of a man who had been drowned some days before, thus naturally adding greatly to the excitement.

We do not pretend to give any explanation of Houdini's performances We can only say that he states that most of the public *exposés* of tricks of this kind are absolutely worthless, as they would not work in practice under the severe conditions of a committee of examination. Possibly some of our readers have original solutions of these mysteries if so, we should be pleased to hear from them



Houdini injured after an Australian dive.

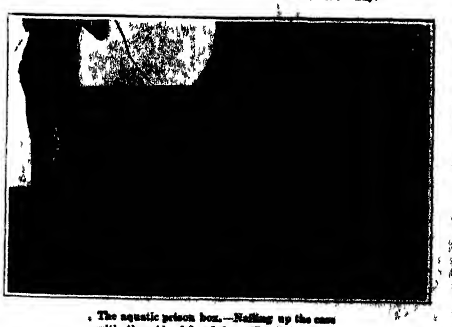


A daring dive in handcuffs.

Preparing for the manacled plunge.

Houdini manacled preparing to enter the box.

Lowering the box into the Bay.



The aquatic prison box.—Nailing up the case with the aid of band iron, Houdini inside.

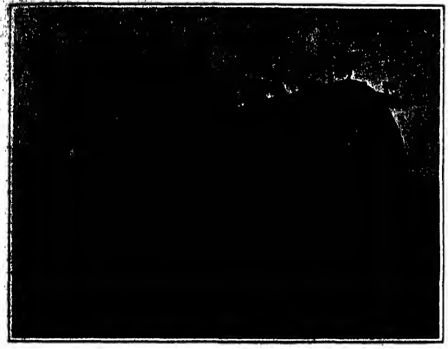
THE DARING FEATS OF HARRY HOUDINI

The Current Supplement

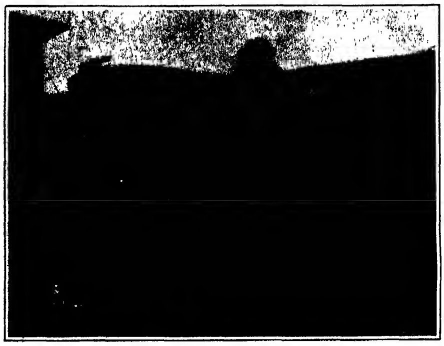
THE manufacture of fuel briquettes in this country is a growing and important industry Some significant statistics on this subject have been collected by Edward W Parker, of the United States Geological Survey, and are summarized in an article appearing in the current issue of the SUPPLEMENT, No. 1907—H S Munroe writes on the toxic effects of carbon monoxide—Prof Bickerton contributes a very interesting article on the origin of the Milky Way—Dr Zahm's masterly contribution on aeromechanics is continued in this number—Reginald R Gordon gives a report on the 1912 Convention of the American Railway Master Mechanics' Association. This report is full of important facts, which no one interested in railroading can afford to leave unread.—Our Berlin correspondent describes in an illustrated article the laying of a cable through the River Trave.—Dr Cannon continues his splendid article on Animal Experimentation—Prof. Fleming, the great English electrical engineer, contributes an article on the conductivity of dielectrics.

Copper Mines in Nova Zembla

PROSPECTING for minerals in the Arctic and Antarctic regions is one of the interesting developments of recent enterprise. The latest news under this head is that valuable deposits of copper have been found in Nova Zembla. Funds for working these deposits have been advanced by a banker in [illegible], and a party of engineers and workmen, [illegible] from the Ural, will proceed in a [illegible] steamer to this far northern land.



The sectional firebox boiler intact after the test.



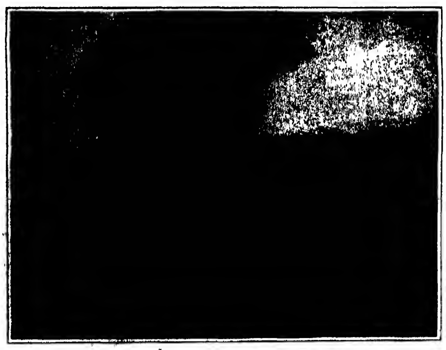
"Bomb-proof" from which boilers were operated and observed. Note telescope.

Blowing Up a Locomotive Boiler

Test of a New Type of Safety Boiler

THE statistics gathered by the State Railroad Commission show that every year an average of fifty locomotive boilers explode, causing a damage to property of several millions of dollars and the loss of more or less than one hundred lives, to say nothing of injuries to a larger number of people. The careful investigations which are carried out under the Commission usually lay bare the defects or mismanagement which led to the disasters; but in many cases it is difficult, and indeed impossible, to determine the cause. Low water in the boiler, due to carelessness or oversight on the part of the fireman, accounts for a large number of explosions. Should the water level fall to such a point that the crown, or roof as it might be called, of the firebox is uncovered, the great heat of the fire raises the temperature to a point at which the metal loses its strength and yields under the steam pressure, tearing loose from the staybolts which normally hold it in position.

In the standard type of locomotive, the firebox is held to shape against the inward pressure by tying it to the outer shell of the boiler with a large number of staybolts. Under normal conditions this construction is sufficient for its purpose. But should the crown of the firebox become overheated through the water falling below its surface and exposing it to the full heat of the fire, the heads of the staybolts and the holes in the crown, softened by the heat, are no longer able to hold against the pressure. The bolts are pulled through, and the crown is crushed in. Of all the causes which lead to boiler explosions, this is probably the most frequent. Among the many attempts to build a boiler which would be proof against this form of accident, the most successful is that known as the Jacobs-Shupert sectional firebox, which was built several years ago in the mechanical department of the Santa Fé Railroad Company from the plans of the two engineers whose names it bears. A large number of these fireboxes have been built and are in service on the Santa Fé and other railroads, where they have rendered excellent service. In order to test the qualities of this boiler, it was submitted to investigation by Dr W. F. M. Goss, Dean of the College of Engineering, University of Illinois. Dr Goss is probably the best known authority in work of this kind; and in investigating this particular boiler, it was determined to make a test on a hitherto unprecedented scale, to determine how far it was proof against explosion due to low water, and at the same time to determine whether low water was a sure cause of explosion when it occurred on boilers of the standard radial-stay type.

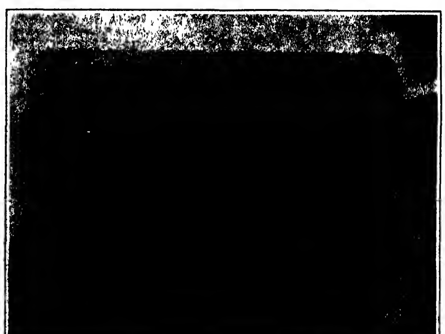


The explosion of the radial-stay firebox boiler.

The demonstration was made at Coatesville, Pa., on June 20th of this year, before a large gathering composed chiefly of engineers representing various departments of engineering. Two full-size locomotive boilers, designed for high speed heavy passenger service, were each subjected to severe low-water tests. Both boilers were identical in size and design except that one had a Jacobs-Shupert sectional firebox, while the other had an ordinary radial-stay firebox. In carrying out the test, both boilers were mounted in a field, fifty feet apart, and they were operated from a "bomb-proof" located two hundred feet away from the nearest boiler. Because of the danger to which a fireman shoveling coal would have been exposed, oil was used for fuel. Grad-

(Concluded on page 66.)

Interior of Jacobs-Shupert firebox, showing [illegible] intact after exposure to intense heat.



Crown of the radial-stay furnace, bulged in after it was torn loose from the stay-bolts.

Rubber Natural and Synthetic

How Will Artificial Rubber Affect the Plantation?

By Prof. F. Willy Hinrichsen, of the Koenigliches Material-Pruefungsamt, Berlin

[The author of this article, Prof. Hinrichsen, has completed for the Koenigliches Material-Pruefungsamt what may well be regarded as a most thorough study of natural rubber, artificial rubber and rubber substitutes. For that reason his comments on the commercial possibilities of the synthetic rubber discovered in Germany deserve more than passing attention. An entirely new significance and interest has been added to the topic by the recent authoritative announcement that a body of English chemists have surmounted the last difficulties in the synthesis of rubber, and have placed it upon what promises to be a sound commercial basis. Prof. Hinrichsen's article was written before this announcement, and is published here in its original form. The reader must supplement his information by reference to our editorial page.—EDITOR.]

IN the last few years the world's consumption of caoutchouc has increased at an extraordinary rate, indeed, so extraordinary, that the supply has not been able to keep up with the demand. The following table statistically summarizes this remarkable increase.

World Production and World Consumption of Caoutchouc.

Years.	World Production in Tons.	World Consumption in Tons
1899-1900	53,348	48,352
1900-1901	52,864	51,136
1901-1902	53,887	51,110
1902-1903	55,603	55,276
1903-1904	61,759	59,666
1904-1905	68,879	65,083
1905-1906	67,999	62,754
1906-1907	74,023	68,173
1907-1908	66,379	62,376
1908-1909	70,587	71,998
1909-1910	76,553	76,026
1910-1911	79,305	74,082

From this table it appears that the consumption of rubber in the year 1908-1909 (the financial year being usually reckoned from July 1st to the following June 30th) exceeded the production. Had it not been for large reserves of raw caoutchouc left over from previous years, the commercial situation might have been alarming.

The Price of Raw Rubber.

This unfavorable relation between production and consumption naturally resulted in a considerable rise in the market price of rubber. The increase in price which would have normally resulted would have been serious enough, but thanks to the stock jobber, rubber brought 12 shillings 6 pence per pound in May, 1910. After that there was a drop. In June, 1911, the price of raw caoutchouc reached a minimum of less than 4 shillings. Then came another increase. The prices that I have here quoted are those for the best quality of Brazilian Para rubber.

The payment of such fabulous sums for natural rubber stimulated efforts to produce rubber artificially, in sufficient quantities and at sufficiently low prices to compete with Para gum. I take it that readers of the SCIENTIFIC AMERICAN are more or less familiar with the methods employed in obtaining natural rubber. Caoutchouc is found in the milky juice (latex) of certain plants, which flows out when the bark is pierced. By proper treatment this milk is converted into caoutchouc. In separating or coagulating caoutchouc the action of heat or chemicals is most important.

Rubber Plantations.

Because the production of natural gum is not sufficient to keep pace with the constantly increasing demand, the more so since whole trees are felled and other most ruthless methods are resorted to, caoutchouc producers have for some years past carried on the cultivation of the rubber tree on plantations. Their rubber may even now be considered the most promising competitor of the wild tree. Enormous areas, especially in Asia (the Malay States, Ceylon, etc.), have been planted with caoutchouc trees. The growth of these trees is rapid, and the amount of caoutchouc annually produced by plantations is constantly increasing. By careful study the most favorable conditions for cultivation—especially the conditions of soil and the most convenient method of coagulation—have been ascertained. In fact, plantation caoutchouc is even now almost as good as Brazilian Para gum. It has brought prices just as high.

More interesting, sensationally so, in fact, is the production of rubber by artificial means, rubber which in its chemical and physical properties is exactly the same as natural rubber.

How Rubber is Made in the Laboratory.

Caoutchouc proper is a compound of carbon and hydrogen, a compound in which these two elements bear the same relation to each other as in a certain well-known class of bodies called terpenes, the main constituents of ethereal oils. From these terpenes some well-known aromatic substances are derived among others. In order to ascertain the manner in which atoms of carbon and hydrogen are fixed in caoutchouc, the chemist must first decompose the caoutchouc, split it up, in other words. If he can do this completely he can obviously discover exactly what elements are required to make caoutchouc. When that mystery is revealed his next task is to take the elements of which caoutchouc is composed and to combine them in the proper way in order to produce artificially a rubber which is chemically the same as the substance obtained from the Hevea tree. Stated thus baldly the problem seems very simple. Yet more than a decade of arduous chemical research has been required before rubber was synthetically produced in the laboratory.

Among the constituents of rubber which are split up by intense heat is a liquid which boils at a low temperature and which in odor and in boiling point closely resembles ordinary ether. That substance is known as isoprene and was discovered by Williams as far back as 1860. Indeed, isoprene proved to be a compound of carbon and hydrogen in about the same proportions as they are found in rubber itself.

Bouchardat, in the course of a comprehensive investigation, found that isoprene, under given conditions, was converted into a substance analogous to caoutchouc. Other experimenters made the same observation later, among them Tilden and Wallach. Frequently, however, the conversion failed to take place. Why? Because the exact experimental conditions which governed the conversion of isoprene into caoutchouc had not yet been ascertained. The failures were so numerous that chemists began to doubt the correctness of earlier observations. It was not before 1909, when F. Hofmann and C. Coutelle, two chemists in the employ of one of the largest chemical works in Germany, found that absolutely pure isoprene is converted into a substance resembling caoutchouc if heated under pressure with and without the intervention of other substances. Independently of these experimenters, C. Harries, at Kiel, discovered the same reaction while heating isoprene with acetic acid.

The Commercial Possibilities of Artificial Rubber.

These experiments have solved the problem of producing rubber synthetically, but as yet only from a scientific point of view. It may here be added that if the initial material be varied in quality and the experimental conditions modified, a number of substances which resemble caoutchouc can be obtained, which are not to be found in nature.

Naturally the business man asks: What is the practical value of this work? Is synthetic rubber merely a laboratory curiosity? Or, can it be produced in marketable quantities at a price to compete with Para gum?

If artificial rubber is to take the place of the natural product, it must be produced more cheaply than Para gum and it must possess all the really essential properties of Para gum. Whether or not artificial rubber can compete with natural rubber depends on so many commercial conditions, it is hard to give a definite answer. Some day it will compete; that much is certain. When that day will dawn, is decidedly uncertain. The struggle is bound to be a hard one. The price of Para gum will surely drop as the caoutchouc plantations are extended and as their annual production increases. The cost of producing a pound of first-class Asiatic plantation rubber is somewhat less than 25 cents. It is possible that even if it costs more to produce artificial than natural rubber, the new laboratory product may have a commercial future if it proves superior in important respects to the natural product.

On the whole, it is not likely that artificial rubber will entirely displace natural and plantation gum, as the coal tar dyes have displaced vegetable dyes. In all probability the natural and artificial products will be sold side by side in the market much as natural and artificial silk are now sold.

The manufacturing cost of artificial rubber depends primarily upon the cost of the raw material from which it is made, isoprene or related hydrocarbons. Patents have recently been taken out to cover processes designed to reduce the cost of the raw material. Isoprene, itself, is obtained not simply from heated caoutchouc but also from turpentine oil and from certain components of coal tar (cresol). Naturally, for practical purposes the isoprene must be obtained from some other source than caoutchouc.

Rubber Substitutes.

Long before artificial rubber was successfully produced various compounds had been discovered which had many of the properties of rubber, but were chemically different from it. Many of these are compounds of oil, shellac and similar substances. Such rubber substitutes, "factices," the French call them, are obtained by treating oils with sulphur chloride, in which case a white rubber-like substance is obtained; or with sulphur alone, in which case a brown imitation rubber is produced. Mixtures of such oil, or sulphur compounds with caoutchouc have proved convenient and serviceable. They seem to last longer than rubber. The imitations or factices themselves, depending upon their process of manufacture, are usually loose and brittle masses of a white or brown color, to be distinguished from rubber by their ready saponification; in other words, they are easily attacked by lyes.

In the patent literature of every country will be found descriptions of plastic masses made from glue, gelatine, cellulose and the like—all alleged to be perfect substitutes for rubber. Some of these have proved of industrial importance. Most of them are valueless because of their inferior elasticity.

Regenerated Rubber.

Foremost among the substitutes for pure rubber may be mentioned regenerated rubber obtained from refuse articles of manufactured rubber. Because of the small supply of natural caoutchouc, the necessity of utilizing the refuse of rubber factories had become almost pressing. According to authoritative estimates, the quantity of old rubber regenerated for the manufacture of rubber articles surpasses the consumption of raw caoutchouc. Such reclaimed rubber is no perfect substitute for new gum. It has lost much of elasticity and strength by the mechanical, physical and chemical processes to which it is subjected. Old rubber shoes, pneumatic tires and the like constitute the raw material from which regenerated rubber is made. When reclaimed the rubber differs in a marked degree from caoutchouc.

Every one knows at this late day that all rubber articles must be vulcanized, in other words, that at certain temperatures sulphur in some form must be added. Although the actual chemical process that occurs when sulphur is thus added is not yet known with absolute certainty, recent investigations show that part of the sulphur compounds are chemically fixed by the caoutchouc. This "combined" sulphur, as it is called, is not eliminated from present regenerated material. In actual practice, the reclaiming or regenerating process destroys the fabrics in the old rubber and converts the remaining vulcanized rubber to a plastic form for further manipulation.

There is no good reason why the sulphur combined with vulcanized rubber could not be removed, theoretically, at least. Most rubber experts, however, have come to the conclusion that the task is hopeless.

Some apprehension has been expressed lest the continual increase in the production of plantation rubber should result in an over-production. Such apprehensions are groundless. Even if the plantations should continue to produce rubber at the present rate, and even if synthetic rubber should also be manufactured, the demand for the natural product will not abate. The quantity of caoutchouc which the world needs is so great that all available sources of supply will be drawn upon. The price, of course, will fall; but that, again, will be offset by increased consumption.

If it were possible for manufacturers to employ synthetic rubber, natural rubber and plantation rubber at very much lower prices than are at present charged, there would be no doubt that the world at large would benefit. The possibilities of rubber are far from being exhausted. The high cost of the raw gum has hitherto limited the applications of one of the most useful substances in the world. When the price of rubber does fall, because new sources of supply have been made available, we may possibly speak of a "rubber age." It is not too romantic to imagine how noiseless would be the street traffic of large cities when rubber becomes so cheap that every vehicle will be rubber-tired, and when even pavements will be made of rubber, which last possibility is not wildly extravagant, inasmuch as rubber pavements have already been used with excellent results.

Inventions New and Interesting

Simple Patent Law ; Patent Office News ; Notes on Trademarks

Cigar-banding by Machine

THERE is usually but one right way of doing a thing as against a large number of wrong ways. In few cases, however, does the disparity between right and wrong ways reach such enormous figures as in the re-packing of banded cigars. The situation is this:

Custom demands that cigars be packed so tightly in the box that they lose their rounded shape and are flattened one against the other. This result is obtained by placing the well-filled box in a mechanical press and leaving it under compression for a number of hours. At the end of that time each cigar is found to possess an individuality of its own. It is unlike any of its fellows. It has yielded here and there to accommodate itself to the crowding and pressing of adjacent cigars. It is of such irregular form that it will not fit in any other position in the box. Obviously, it would not do to band this cigar before it had assumed its final form, for otherwise the band would not fit snugly, and it would be mussed and crumpled in the press. Therefore, it is necessary to remove the cigars from the box after they have been compressed, and band them separately one by one, replacing them in their original container in the same order as they occupied under the press. Unless care is taken to restore each cigar to its original position, trouble is sure to ensue. Once the order is lost, the chances of rediscovering the original arrangement are hopelessly against the operator. Consider a single row of twelve cigars. It is a simple mathematical problem. Multiply 1x2x3, etc., up to 12, and the result will be 479,001,600 different ways in which those twelve cigars may be arranged. If we consider an entire boxful of cigars, the number of wrong ways in which they can be put in the box will reach such a stupendous figure as to pass entirely beyond the comprehension of anyone but an astronomer. Realizing this as well as the fact that objects not uniform in shape are difficult to handle, cigar manufacturers have declared stoutly that the banding of cigars after having been packed could never be accomplished by machine.

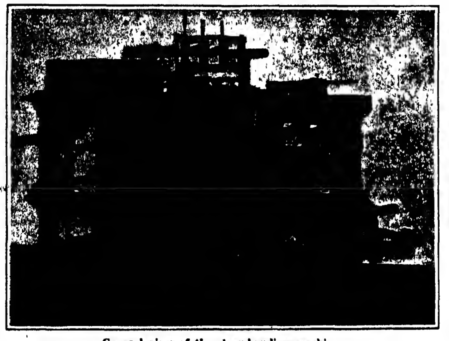
According to the latest report of the Internal Revenue Department, there are some 25,000 cigar manufacturers in the United States, making about eight billion cigars per year, and it is conservatively estimated that fully six billion of these are banded. As all this work is now done by hand, this means that there are six billion separate hand operations requisite. The work is done by girls at almost incredible speed. Yet the cost of banding runs up into the millions of dollars per annum, and imposes a heavy burden on the cigar industry. A number of years ago a banding machine was invented for banding loose cigars. However, as the number of unpacked banded cigars is comparatively small, this machine did very little toward relieving the situation.

About a year ago, we described a machine which had just been built for banding packed cigars. While that machine did actually band cigars, after they had been packed, it was not adaptable to certain special demands of the cigar manufacturer. Accordingly, a second design has been developed, which is shown in the accompanying illustrations. This machine is so improved and simplified as to appear like an entirely different mechanism. It will take the cigars from a box, band each one separately, place the band in the center, or at any other desired point on the cigar, reverse the band for alternate rows, if so desired, and restore all the cigars to the box, doing the work at the rate of about 60 per minute with a single operator, as against two in the old machine.

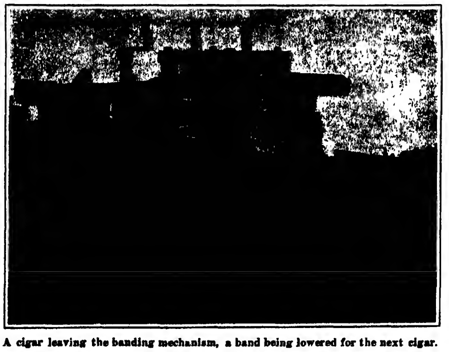
The cigars are removed from the box and placed on a tray without disturbing their relative order. The tray is then placed in the container shown at the left-hand side of one of our photographs, and thence the cigars are moved row by row out upon a receiving table. The most conspicuous object in this photograph is a cam with two broad wings. When the cam roller drops off the point of one of the wings to the base of the other, it acts to eject the bottom row of cigars from the tray. Thereupon the ejector is slowly retracted, until, by the time the first row has passed through the banding mechanism, it will be ready to eject the next row in the tray. The cigars are picked up one by one from the receiving table by a forked suction tube and placed on a pair of fingers or hollow stems of rubber, connected with a vacuum pump, so that they will hold the cigar firmly by suction, yet without danger of injuring the wrapper. Before the cigar is carried to the banding point, a suction finger rises vertically and removes a band from the bottom of a pile placed directly above the banding point. The cigar is then carried over the band and pressed down with it between a pair of spring-pressed guide-plates shown at A in the line drawing, which fold the paper closely around three sides of the cigar. Thereupon a tucker plate B folds one end of the band down upon the cigar. Above the tucker plate is a gumming device, consisting of a tube terminating in an inclined plate C provided with two small perforations. Through these perforations two beads of gum about the size of a pin-head are squeezed out on the plate and are wiped off upon the other end of the band as it is folded down by means of a rubber-coated roller D. At the same time the tucker plate and gumming device are withdrawn, the tucker plate serving to shield the cigar-band from gum scraped off the gummed end. Above the gumming device is a plate E, which serves as a guard to prevent the band from coming in contact with the gum as it is drawn down into position to receive the cigar. While the cigar is being banded the rubber fingers which carry it to that position return to get another cigar, while a second pair of suction fingers take the banded cigar and carry it over to a delivery table. Thus the process is continued until a complete row of cigars has been delivered, whereupon a pusher slide moves the entire row endwise into the tray shown in the foreground of the photograph at the right of the machine. After receiving a row, this container moves down to the proper position for the second row, and when the entire box of cigars has been banded the cigar box is inverted and placed over the tray. It will be noted that the arrangement of the cigars in the tray at the delivery end is exactly the same as that at the receiving end. The box and tray are now revolved together so as to bring the box right side up, whereupon the cigars are forced out into the box, as shown in one of the illustrations. The tray is double, so that when it is revolved to discharge one section, a second section is brought into position, and the work of the machine can proceed without interruption.

In our enlarged view of a portion of the machine may be seen a small hand crank upon a threaded vertical shaft. This shaft forms the plunger rod that projects from the gum cylinder. A ratchet mechanism is operated to feed the plunger down as each cigar comes to the banding position. The amount of gum required for each band is so minute that a reducing gear is required between the ratchet and the plunger. At each operation of the ratchet the plunger is made to move down one ten-thousandth of an inch. The actual amount of gum in each bead on the gum plate is 0.0001 cubic inch. The cylinder is large enough to store a day's supply. To refill the cylinder, the hand crank is operated to withdraw the plunger and thus suck in the gum.

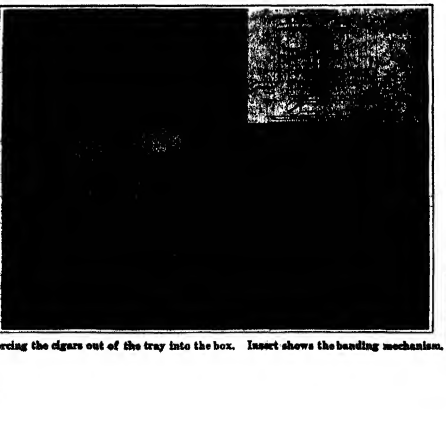
Some dealers prefer to have the bands applied near one end of the cigars instead of centrally. To provide for this an end-stop is used for the ejector slide, and by adjusting this stop with respect to the banding point the position of the band upon the cigar may be determined. When it is desired to reverse the bands in alternate rows, a cam connection is made, which causes the suction finger, as well as the entire banding mechanism, to revolve through an angle of 180 degrees after each band is removed from the pile, thus reversing the position of the band. This reversal will continue for the entire row of cigars, after which the parts will be turned to normal position and there will be no reversal while the next row of bands is being applied.



General view of the cigar-banding machine.



A cigar leaving the banding mechanism, a band being lowered for the next cigar.



Forcing the cigars out of the tray into the box. Insert shows the banding mechanism.

It is customary to pack cigars in rows of 12 and 13 alternately, or in rows of 10 each. The mechanism is arranged to accommodate itself to such packing. The cam shaft which feeds the cigars to the receiving table and controls the feed from the delivery table is moved by a ratchet mechanism. Two ratchet wheels are provided, one of which has 13 teeth on one half and 12 on the other, while the second ratchet wheel has the same number of teeth on each half. When the ratchet pawl is thrown into the former ratchet wheel it will feed the shafts at the rate of 13 steps for one-half revolution, and 12 steps for the other. When, however, the ratchet pawl is thrown into the other wheel, the feed will be uniform. Another adjustment provides for regulating the machine to handle boxes of 25, 50 or 100 cigars. A ratchet wheel with 100 teeth is employed, and if there are 100 cigars to the box the pawl engages 1 tooth at a time, if 50 to the box, 2 teeth at a time; and if 25 to the box, 4 teeth at a time. The machine can thus be adjusted to practically every requirement of the industry.

The Trade-mark as a Business Asset

By W. E. Woodward

[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer, that it is a symbol of good will, a tangible asset with a determinable money value, that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the second of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

The Federal Trade-mark Law—II.

The function of a trade-mark is to denote origin.

Throughout its history the trade-mark has remained true to its ancient antecedents, and its purpose to-day, as it was in the fifteenth century, is specifically to indicate the origin of an article of merchandise.

In this aspect of unchanging purpose, the trade-mark is somewhat an anomaly in commercial history. During the last four hundred years, methods of manufacture, distribution and sale have been revolutionized from top to bottom· banks, which began as mere money-changing offices, have become establishments for keeping and loaning funds, the retailer, who used to sit in a hole in the wall with a handful of goods, all of the same kind, has developed into a merchant selling ten thousand different articles, the craftsman, who once served a long apprenticeship, during which he learned to make every part of a shoe or a carriage, has become a specialized laborer, employed by the day to produce the extreme subdivision of a finished article.

The reader should understand clearly that the right to own a trade-mark is not a creation of the statute, for the use of trade-marks, and the recognized right of manufacturers to be protected in their use, far ante-date any specific trade-mark legislation.

The intent of the statute is to systematize and codify trade-mark practice It provides a definite procedure for the registration of trade-marks, lays down rules for validity in marks, puts trade-mark litigation, when registered trade-marks are the subject matter of the litigation, within the jurisdiction of the Federal courts; and makes every trade-mark registered under the law a part of the public records of the nation. But a trade-mark may be legally sound even if not registered, just as a person may own real estate without recording the title.

The ownership of trade-marks, like every other property right, is recognized by the common law. The Supreme Court of the United States has said: "The right to adopt and use a symbol or device to distinguish the goods or property made or sold by the person whose mark it is, to the exclusion of use by all other persons, has been long recognized by the common law and the chancery courts of England and of this country. It is a property right for the violation of which damage may be recovered in an action at law, and the continued violation of it will be enjoined by a court of equity with compensation for past infringements."

Trade-marks, under the Act of 1905, are registered in the United States Patent Office.

In case of litigation resulting over the right to use any trade-mark, evidence of the registration of the mark by one of the litigants puts the burden of proof upon the other. In other words, the user of the unregistered trade-mark must prove priority of use and ownership. This is often a very difficult thing to do, especially in the case of trade-marks that have been used a long time, for such proof must necessarily rest upon the production of old labels, packages of the goods with the trade-mark affixed, and testimony of witnesses

The owner of a registered trade-mark does not need any evidence other than the public records of the Patent Office to establish the date of his first use of the mark.

When a trade-mark is not registered in the Patent Office, litigation concerning it does not come under the jurisdiction of the Federal courts, unless the opposing parties are citizens of different States.

On the other hand, all cases pertaining to registered trade-marks fall within the field of Federal jurisdiction, irrespective of the amount in dispute or the place of residence of the parties. There is an obvious advantage in this, owing to the fact that an injunction secured in one Federal court will be enforced in all such courts in any State.

The fee charged by the Patent Office, under the law, for registering a trade-mark is ten dollars This does not include the attorney's fee, which must be paid by the applicant.

A certificate of registration remains in force for twenty years, and it may be renewed upon expiration, for like periods of twenty years, upon payment of a renewal fee of ten dollars.

An individual or corporation has a right to register a trade-mark under the United States law if the trade-mark for which registration is sought belongs to the applicant and is used by *him*:

1. In commerce among the several States.

2. Or, in commerce with foreign nations.

3. Or, in commerce with the Indian tribes.

Provided the owner of the trade-mark resides within the territory of the United States (which includes all territory under the United States control), or has a business establishment situated in United States territory, or resides in any foreign country which affords, by treaty, similar privileges to citizens of the United States.

Divested of legal verbiage, the main provisions of the Act, so far as the features governing registration are concerned, may be stated as follows:

A trade-mark is not registrable if it is:

A design or wording identical with a registered or known trade-mark owned and in use by another, and appropriated to merchandise of the same descriptive qualities, or which so nearly resembles a registered or known trade-mark owned and used by another and appropriated to merchandise of the same descriptive qualities, as to deceive purchasers, or to be likely to cause confusion in the mind of the public.

The insignia of the American National Red Cross Society.

The flag or coat of arms of any foreign nation.

Any design or picture which has been adopted by a fraternal society as its emblem.

A portrait of a living individual unless the application for registration is accompanied by the written consent of the individual whose portrait is used.

Scandalous or immoral matter of any description.

The flag or coat of arms of the United States, or of any State, or of any municipality, or any of the insignia thereof.

Any geographical name or term.

A misrepresentation of the quality, composition, character, origin, or nature of the commodity with which it is used.

Any mark which consists merely in the name of an individual, firm, corporation, or association, unless said name is written, printed, impressed or woven in some particular or distinctive manner, or is used in connection with a portrait of the individual.

Any arrangement of words or devices descriptive of the goods with which they are used, or of the character or quality of such goods. In other words, a trade-mark must not be an advertisement in the ordinary sense of the word.

A trade-mark is registrable if it is:

Unlike any other trade-mark already in use, and applied to the same class of goods. It must not resemble the trade-mark of a competitor, or of a potential competitor, to such an extent that the buying public is likely to be deceived or confused by the resemblance.

The business name of a person or firm when written, printed, impressed or woven in some distinctive manner, or in association with a portrait, or in an autographic form.

Any trade-mark symbol, or word, or words, or a combination of a device and wording, not obviously descriptive of the commodity to which it is to be applied

Any trade-mark which has been in continuous and exclusive use by the applicant since February 21st, 1895

Used in lawful trade

Of such a character that it may be affixed, printed upon, woven, sewed, branded or otherwise impressed upon the product with which it is used, or upon the package or container of the product

(*To be continued.*)

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

AEROPLANE.—LOUIS F BANCROFT, 36 Pearl St., Hartford, Conn. This invention relates to a novel form of aeroplane, and more particularly to one having automatic stabilizing devices co-acting therewith An object is to provide means for automatically maintaining or restoring the lateral and longitudinal balance of the aeroplane. Further, an object

AEROPLANE.

is to provide an aeroplane having stabilizing surfaces and guiding elements which may be manually operated to convert the same into additional stabilizing elements. The inventor has on many occasions proved that transverse and longitudinal stability of his flying machine has been automatically maintained. The aeroplane is shown in a plan view equipped with a preferred embodiment of the invention.

WING FOR FLYING MACHINES.—G. KOAR, Hamburg, Germany. This invention comprehends a wing having a longitudinal tapering staff made of material more or less resilient, the smaller end of the staff extending to, and in part constituting the tip of the wing, together with feathers, each having a stem and one or more fins extending from the stem, each fin being of composite structure.

Electrical Devices.

INSULATOR.—H. LANGE, Kiel, and F. DRUCKENMÜLLER, Cologne-Nippes, Germany. This invention provides an insulator to be used in connection with high-tension conductors of over-head electric systems for wireless telegraphy and telephony, as well as with supporting tackle used with the masts of wireless telegraph systems, which possesses great strength, is of high resistive power, presents a large surface, is of small circumference and light weight, and which can be inexpensively produced.

DISSOLVING VIEW DISPLAY APPARATUS.—G. T. [illegible], JR., [illegible] Ave., N. Y., N. Y. This invention relates to electrically controlled [illegible] exhibiting apparatus, and its object is to provide a new and improved dissolving view apparatus, in which the display matter gradually appears and disappears to produce a highly interesting effect to the onlooker.

BURGLAR ALARM.—G. DI GIOVANNI, 1488 Washington Ave., Bronx, N. Y. This improvement relates to burglar alarms, the more particular purpose being to provide an electric alarm associated with a number of cords so arranged that the cutting of any cord, or the stretching of any cord, as the case may be, will cause the alarm to be actuated.

SPARK ARRESTER.—B. C. MOXLEY, Box 631, Hoquiam, Wash. Mr. Moxley has for the object of his invention the provision of a simple inexpensive device capable of attachment to any stack without change in the same, and without diminishing the draft, by means of which the unconsumed solid matters ejected from the stack will be held in the arrester.

Of Interest to Farmers.

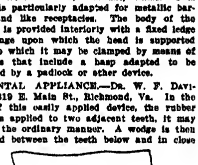
PLOW BEAM.—J. M. RIVERS, Lock Box, 284, Fort Meade, Fla. This invention is an improvement in plow beams and has for an object the provision of a novel construction of metallic beam which will be light, will effectively serve its purpose and will permit the adjustment of the different parts as desired in the practical use of the machine.

BROODER.—G. H. LEE, 1115 Harney St., Omaha, Neb. This invention provides a brooder with a movable or portable hover; constructs and arranges the hover so as to alternately confine the chicks under the hover or to free them therefrom; provides a hover open at the top to receive heat producing and heat retaining accessories if required, and means to limit the extent of the brooder.

Of General Interest.

REMOVABLE HEAD FOR BARRELS AND LIKE RECEPTACLES.—G. W. STAPLES, care of A. W. MARSHALL, Anahuac, Texas. This head is particularly adapted for metallic barrels and like receptacles. The body of the barrel is provided interiorly with a fixed ledge or flange upon which the head is supported and to which it may be clamped by means of devices that include a hasp adapted to be secured by a padlock or other device.

DENTAL APPLIANCE.—DR. W. F. DAVISON, 819 E. Main St., Richmond, Va. In the use of this easily applied device, the rubber dam is applied to two adjacent teeth, it may be in the ordinary manner. A wedge is then pressed between the teeth below and in close



DENTAL APPLIANCE.

proximity to the outer side of the rubber dam until the wedge clamps by its wedging action between the teeth. The inner and the outer ends of the wedge are then bent to secure the wedge in place and to hold the dam out of the way. The illustration herewith presents a front elevation of the invention as in use

DEVICE FOR MEASURING DRAFT ANIMALS FOR COLLARS.—D. S. BROWN, Watertown, N. Y. The object of the present invention is to provide a simple and inexpensive device by means of which the exact measurement of the neck of the draft animal from the largest to the smallest size, may be obtained. When not in use, the device may be hung up, by engaging the hook with a nail or the like, the catch preventing withdrawal of the bar.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

A Hangar Ship

By Capt. W. Irving Chambers, U. S. Navy

I HAVE received numerous requests from leading papers and magazines to supply details of a "hangar ship" which I am credited with having recommended to the Navy Department, and, as the idea of a hangar ship seems to have captivated many who are interested in the development of naval aviation, it seems necessary to publish the facts and to correct a false impression as to my attitude in the matter.

I have never made any such recommendation for the reason that I do not believe that we need such a vessel, even if we could get it. If it is not needed a grave error would be made in asking Congress to consider the proposition.

My views on this subject may be found recorded in the Proceedings of the U. S. Naval Institute for June, 1912, page 745, where, in the discussion of the able article on Naval Aviation by Lieut. Lapointe, of the French navy, I say, "I am quite sure that the majority of our naval officers will agree with this writer on the relative importance of 'capital ships' and auxiliaries."

The reference may be found on page 650 and reads as follows:

"I agree that the navy should be made up of ships, as many ships as possible for the money available. But I also believe that these ships should be of the type to assure victory in battle—battleships—'capital ships.' Cruisers, scouts, destroyers, torpedo boats and submarines are all auxiliary to the battle fleet. Though such auxiliaries are many, their importance must not be exaggerated to the point of spending on them half, or more than half, of our appropriation, as has recently been done. The navy has suffered from a craze for flotillas of useless and costly auxiliaries of every type, whose only reason for existence is a supposed economy.

"A short time ago the true state of affairs was realized, and the construction of torpedo boats and cruisers was discontinued."

And on page 653 he states: "But it is *evidently* a great advantage to have an aeroplane stationed on a ship from which it can be launched and upon which it can land. For such a purpose a *garage vessel* has been proposed to accompany the fleet and shelter a half dozen aerial scouts. But in order to be of any real value such a ship must be a great vessel with enormous deck space and with a speed equal to that of the fleet. The probable cost of 15,000,000 francs would hardly be justified, even if the number of cruisers were reduced. Besides, such expense is not necessary. Modern battleships of the largest size can easily provide space for the launching and landing of aeroplanes without interference with essential features of design or great expense. In addition, an aeroplane can easily be taken apart and stowed below if it be desired to keep it aboard during action—this is hardly probable, however. At any rate, the problem of rising from a ship's deck and landing upon it is now being studied by able minds, and we can expect a practical solution at any time."

My opinion of the "*garage vessel*" is registered in the discussion, page 745, as follows: "Furthermore, the use of a garage vessel would add another of the needless auxiliaries, which according to his reasoning should be avoided."

The ingenious author of the newspaper hoax, referred to primarily, states that "the first hangar ship shall be of size, cruising radius and speed sufficient to enable it to maintain its proper place with either a battleship fleet or a fast scout cruiser squadron. The idea is that aeroplanes may be used far in advance of the actual fighting units, in which case they should, it is said, be carried on a vessel attached to the scouts rather than the real fighters. On this account great speed will be necessary for the hangar ship."

Other details he gives, but the more they are analyzed, the more it becomes apparent that the ideal "hangar ship" is the ideal scout itself. Certainly the scout must have no peer in speed and it would surely be out of the question for one such ship to be of any use in supplying aerial accessories to a dozen or more scouts scattered over an extensive scouting line.

Now it has been my idea from the beginning that all scouts should be supplied with naval aeroplanes and fitted to use them, just as soon as we can determine exactly what is needed for the fittings. This is the idea that prompted the use of the scout "Birmingham" for the first demonstration in flying from a ship.

I go further, however, in believing that all large ships, battleships and armored cruisers, should be supplied with naval aeroplanes, for which there are many important uses other than scouting. But the most urgent reason for placing them on the larger ships first, as soon as practicable, is that it is only by having the aeroplane right in the *midst of the fleet*, in the company of the officers and mechanics who must be made as familiar with it as they are with guns and boats, that we can expect to instruct and exercise our people in its use and thereby study *its efficiency for our purposes*.

The French have designated the "Foudre" as a sort of base hangar for purposes of instruction. Were we to adopt this policy, it would mean the use of any old hulk that could be spared and we would still be confronted with the difficulty of providing the officers and men to man her and the people to receive the instruction away from the ships to which they belong. Furthermore, the policy that I advocate is to have this instruction *going on at every suitable place* where the fleet is apt to assemble, in whole or in part, periodically or permanently.

One "Foudre" could not be in all these places at once and the supplies that she is supposed to carry would be more conveniently carried on board of the necessary auxiliaries, such as the fuel ships, the transports and the repair ships.

In view of our difficulties in getting battleships and essential auxiliaries from Congress, I hope the misguided author of this newspaper hoax will endeavor to correct the false impression that he has created concerning this absolutely impossible special "hangar ship."

However, I do not wish to attribute any but the best of intentions to this author, although he ruffled me a bit by committing me to a preference for the products of a certain factory. But I feel that he must have good intentions because he places me in the category of a "*young officer*," and I am led to hope that it is because he has in mind an essay that I wrote for the U. S. Naval Institute in 1884. I was young then, but, on page 30, Volume XI, may be found the following precept:

"The great secret in naval economy, which many nations have yet to learn, is *to maintain nothing superfluous or inefficient.*"

I am still young enough to stand by that sentence written twenty-eight years ago and, therefore, I do not believe in the "hangar ship."

Growth of the Automobile Industry

THE best way of presenting dry statistics in a form that is both interesting and quickly comprehensible is to use a graphic comparison. Some idea of enormous quantities can thus be readily grasped. Last year the automobile manufacturers of the United States produced 200,000 cars. But how could we possibly show a picture of this vast number of automobiles in the Scientific American and have room for anything else in the same issue? We are forced by circumstances to fall back upon the common method of showing bulk rather than numbers. We have therefore shown in our front page illustration a single car representing the entire output for the year. In other words, if all the material used in the automobiles manufactured last year were put into a single car, the giant product would be 59 times as long, 59 times as high and 59 times as wide as an average machine. Our giant car would tower to a height of 342 feet, or within 100 feet of the top of the Municipal Building which is now being

erected alongside the Brooklyn Bridge. We have had to show this car head-on in the picture, because our page is too narrow for a side view.

The actual number of automobiles in use in 1911 is estimated at 677,000. These, if put into a single car, would make one 660 feet high, and we would scarcely have room on our front page for even a head-on view of the machine.

Though comparisons of bulk are very convenient, we must confess that they do not convey an adequate idea, particularly in products of the nature of automobiles, whose value is represented by the work done upon them rather than by the quantity of material used in them. According to a recent Census Report, the value of the automobile industry in 1909 stood at $249,202,000 for the product and for the value added by manufacture $117,556,000, and in this particular it ranks seventeenth among the big American industries. The same report gives the number of wage earners employed in the manufacture of motor cars, bodies and parts, as 75,721. Our comparison falls short when it comes to showing the number of wage earners and the value of the product. It will be readily apparent to anyone that the giant automobile made up of materials that went into all the automobiles manufactured last year would have a far smaller superficial area and consequently much less hand or machine finished surface than that of all the automobiles considered individually. Consequently, there would be far less labor involved in the making of this huge automobile and the value added to the product by manufacture would be much less proportionately.

The Census Report just referred to gives the per cent of increase of all the big American industries from the year 1899 to 1909. Only fourteen industries show an increase in output of more than 100 per cent, but the motor car industry shows an increase of 5,148.6 per cent in value of product and 3,278 9 per cent increase in number of wage earners. The next best industry in the latter particular is that of electrical machinery, apparatus and supplies which shows a percentage of 107.7, while the second best as regards value of products is 155 per cent shown by the copper, tin, sheet-iron products.

The automobile industry may now be said to have passed its period of infancy and adolescence, and attained an age of maturity. Hitherto there have been such marked changes in design from year to year, that car owners were constantly discarding their old cars and buying new ones. Now the automobile has reached a standard form. Such new developments as are found in the annual catalogue relate to non-essentials and minor details. The man who buys a car to-day may be assured of a machine that will last him for a number of years without growing hopelessly out of date. In the next ten years, therefore, we cannot look for anything like the increase in production that was shown in the decade just past. Despite this fact, however, the automobile industry has not yet reached the peak of maximum production. Our esteemed contemporary, the *Automobile*, after writing to the automobile manufacturers of the country for confidential reports of their output last year and their probable output this year, obtained the figure for 1911, which we have already given as 209,957 cars, and the probable output for 1912 as 247,427 cars. The production of cars in the first two or three months of the year is always higher than for corresponding periods during the balance of the year. In January last 58,422 cars were produced as against 28,581 in January, 1911, and in February of this year 70,242 as against 34,265 last year. Very evidently the estimate of 40,000 odd cars more than last year on the total year's production is not at all too large.

How can this enormous production of cars be disposed of if we accept the estimate of 677,000 automobiles now in use, or one in every 140 of the population? This estimate by the way was very carefully compiled by the *Automobile* and is as reliable as any that can possibly be made. The answer is to be found in our front-page

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. In every case it is necessary to give the number of the inquiry. Where manufacturers do not respond promptly the inquiry may be repeated. MUNN & CO., Inc.

Inquiry No. 9354.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9355.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9356. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9357. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9358.—Wanted addresses of parties having gum materials to offer in any part of the world.

Inquiry No. 9359.—Wanted to buy a machine for removing the coating of a [illegible].

Inquiry No. 9360.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9361.—Wanted, a manufacturer to make card games.

Inquiry No. 9362.—Wanted, to buy a glass which is a non-conductor of electricity, and the address of the makers of the same.

Inquiry No. 9363.—Wanted, name and address of manufacturer of [illegible] stretchers with clamps, which is capable of being folded up.

Inquiry No. 9364.—Wanted, the name and address of manufacturers of Date Pitting Machines.

Inquiry No. 9365.—Wanted, names and addresses of manufacturers of machinery for making picket fences.

Inquiry No. 9366.—Wanted, to buy machinery for fastening wire [illegible] with [illegible] tacks.

Inquiry No. 9367.—Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9372.—Wanted, to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9374.—Wanted, the name of a manufacturer of a machine to make cushion covers for [illegible] chairs.

Inquiry No. [illegible].—Wanted, name and address of manufacturer of [illegible] patterns of [illegible] job printing presses.

Inquiry No. 9376. Wanted a [illegible] which can be [illegible] at a [illegible] price, [illegible] from $1.00 to $[illegible].

Inquiry No. 9377. Wanted. A machine for [illegible].

Inquiry No. [illegible]. Wanted. A machine for [illegible] from the shell.

Inquiry No. [illegible].—Wanted [illegible] machine for [illegible].

Inquiry No. [illegible].—[illegible] machinery for [illegible].

illustration which shows what an enormous export business is now being done. The automobile was introduced into this country from abroad, but while we used to import large numbers of cars, the imports are now dwindling very rapidly. In the year 1909, 1,645 cars were brought into the country. The next year the import dropped to 1,024, and last year it fell below the 1,000 mark to 972. In the same year our export grew rapidly. In 1909 we shipped out of this country 4,686 cars; in 1910, 8,443 cars, and last year the figures leaped to a total of 15,807. These quantities are shown in the illustration by single cars representing the import and export, respectively, for the different years. It will be observed that the car for 1911 is quite a sizable one compared to the total production of the year. Our illustration also shows the amount of money paid out for imported machines and the amount taken in on exported machines for the same year. This money represents the actual value of the cars and does not take into account large sums taken in for the export of automobile parts and tires. Most of last year's products went to Canada, which took nearly 5,000 automobiles at a value of $5,500,000. Large quantities were also exported to Great Britain, particularly the smaller cars. Census figures place the total at 4,021, valued at $3,380,266.

An advance bulletin just sent out by the Bureau of Statistics places the probable total of exports for the fiscal year ending June 30th, 1912, at $27,000,000 worth of automobiles and accessories parts. During the ten months ending with April 17,000 automobiles have been exported, worth about $16,500,000; and adding to this the value of automobile parts, engines, tires, etc., we have $22,000,000 for the ten months. Only one country in the world exceeds us in exports of automobiles. France sent abroad $24,640,000 worth in 1908 and her trade grew to $31,700,000 last year. In the same period of time our exports grew from $5,000,000 to $20,000,000, and in all probability the United States will take premier position within the next two or three years.

The value and cheapness of the American product is being recognized throughout the world. American automobiles are sold in all European countries and the market is increasing every year. We have an excellent opportunity to sell machines in South America and no doubt this field will be cultivated from now on. It seems, therefore, that although we at home are beginning to use our cars for longer periods and are satisfied with second-hand cars, there will be no curtailing of the output of the automobile manufacturer for a long time to come.

Resuscitation from Electrical Shock

(*Concluded from page 58.*)

Seattle, in June, and adopted, but are still subject to any improvement that may be suggested and is really worth adoption The booklet rules include a section on the 'First Case of Burns," and are to be issued in a flexible cloth cover.

Two other important subjects still remain for disposition. One of these is the approval or recommendation of devices for continuing artificial respiration. The commission has already examined some of the devices obtainable, and will report its conclusions later. It believes thoroughly in the desirability of a practical apparatus which will furnish thorough ventilation of the lungs, for even the best manual treatment may be far from satisfactory or infallibly efficacious. One of these devices has, it is said, proved very effective in its treatment of the lower animals.

But there is left the third great work of the commission. It has followed Goethe's advice in attacking the question that was next or nearest at hand, and has laid down rules that will save many valuable lives. The third task of the commission is an investigation of the possibilities of restoring the fibrillating heart of a shocked person to its natural pulsation. On this part of the subject, Dr. Cannon, president of the commission, in his preliminary official report says: "The electric current may kill

either by temporarily paralyzing the nervous control of the muscles of respiration, or by stopping the regular beat of the heart. When the heart is seriously affected, it ceases to contract as a whole, but continues to contract in parts here and there, so that it appears to quiver. It is then said to 'fibrillate.' In this condition the heart fails to keep the blood circulating, and death quickly results. At present no practical procedure has been discovered which will restore the regular beat of the heart in man after it begins fibrillating. The chief hope of resuscitation for the present lies in proper treatment of the cases of paralyzed respiration, and the immediate necessity in these cases is promptness in applying artificial respiration and continuance of the process until natural breathing returns. In some instances, however, the heart may be merely weakened without being made to fibrillate; then again artificial respiration may be of vital importance, because a greatly weakened heart leads to impairment or total stoppage of respiration, which in turn destroys the last vestige of the heart beat. In all cases, therefore, an attempt should be made to restore natural breathing." Here, then, is a grave problem that has heretofore defined all the resources of medical science. While the efforts of this notable commission may once more be attended with failure, it is well that the attempt is again put forth to win such a boon for mankind. Electricity has done so much to change the older conditions of life and civilization, one is sometimes tempted to appropriate to it the inspired saying: "Behold, I make all things new;" and certainly it never had a nobler field of effort than this to which that progressive body, the National Electric Light Association, has pledged its financial and inventive resources.

Blowing Up a Locomotive Boiler

(Concluded from page 59.)

uated water gages were mounted on the back head of the boilers, and these were read through a telescope which was mounted on the crest of the bomb-proof. Each boiler was brought to a condition corresponding to its regular operation in railroad service, when it has an estimated maximum power of fourteen hundred horse-power, which is equivalent to that required to haul a heavy passenger train sixty miles per hour. The supply of feed water was then shut off, all the other conditions remaining unchanged.

The water level, under the control of the operators, gradually fell, exposing the crown sheet and other portions of the heating surface to the full effects of the fire. Under normal conditions, these surfaces are protected from over-heating by contact with the water; but in these tests the lowering of the water level deprived the plates of this protection and they became red hot.

The boiler with the Jacobs-Shupert firebox was continuously tested under these severe conditions for fifty-five minutes, without developing any failure, notwithstanding the fact that the level of the water fell to a point more than twenty-five inches below the crown sheet. It may have fallen lower, but the water gage glass did not read below twenty-five. The test was then discontinued because the small amount of water remaining did not evaporate sufficiently fast to supply the draft necessary to maintain the fire. At the conclusion of the test, the firebox was apparently in good condition and ready for further service.

The ordinary radial-stay boiler was then tested under conditions identical to those above described. After the test had been in progress for twenty-three minutes, and the water level had fallen to 14½ inches below the crown sheet, an explosion occurred. The crown sheet and the stays which hold it in place, having become highly heated, pulled away from each other and released the pressure in the boiler. The discharge of steam was through the firebox, and the force of the explosion threw parts of the furnace in all directions, and proved sufficient to ...

the entire boiler, weighing forty tons, several feet above its foundation. The boiler was so damaged as to render its reconstruction necessary.

The steam pressure during the Jacobs-Shupert test varied between 215 and 225 pounds for the first twenty-seven minutes, and gradually dropped thereafter until it reached fifty pounds at the end of the test. The steam pressure on the radial boiler varied between 200 and 230 pounds, being 228 pounds when failure occurred.

In the boiler which successfully withstood this severe ordeal the place of the radial staybolts is taken by a series of deep flanges, which extend from the outside boiler shell to the inner shell of the firebox. The firebox shell consists of a series of U-shaped channel sections which are riveted to the inside edges of these flanges. This affords an exceedingly strong construction. Not only does each U-section present an arched form well calculated to carry the pressure, but the very strong riveting of each section to the inner edge of the flanges presents an enormous amount of sectional area to withstand the shearing stresses which must be overcome before the crown sheet can be torn loose and crushed in.

Luminous Phenomena Associated With Earthquakes

THERE is an old and widespread belief that great earthquakes are usually preceded, accompanied, or followed by various luminous phenomena, in the earth or the sky. These are sometimes described as vague illuminations of the air as a whole, glows and flashes of undefined source, phosphorescent clouds, etc.; or more definitely as lightning-like discharges (including fireballs), flames and columns of fire proceeding from the ground, and phenomena resembling shooting stars.

Prof. Ignazio Galli, of Rome, has taken the trouble to collect descriptions of these phenomena from all available sources, and has made them the subject of an elaborate memoir, originally published serially in the *Bolletino della Societa Sismologica Italiana*, and subsequently issued as a separate pamphlet of 230 octavo pages. The author cites textually 148 cases, dating from before the Christian era to the 20th century. Of 130 cases, 27 occurred by day and 103 by night. An analysis of 109 earthquakes shows that 52 were preceded, 37 accompanied, and 20 followed by luminous phenomena. In connection with the great Calabrian earthquake of 1905, such phenomena were reported from 42 localities, chiefly as having occurred before the earthquake.

Undoubtedly many of these phenomena were ordinary lightning flashes accompanying thunderstorms. When a quake occurs in a town, concomitant luminous phenomena may easily be explained as the result of fires breaking out in buildings, the sparking of crossed electric wires, etc. Other cases may be attributed to the ignition of subterranean gases, released by the rupture of the ground. There seems, however, to remain a minority of cases, especially when the luminous appearances preceded the earthquake, in which none of these explanations apply. As to the luminosity of clouds and fog, this phenomenon has often been reported, but by no means exclusively in connection with earthquakes.

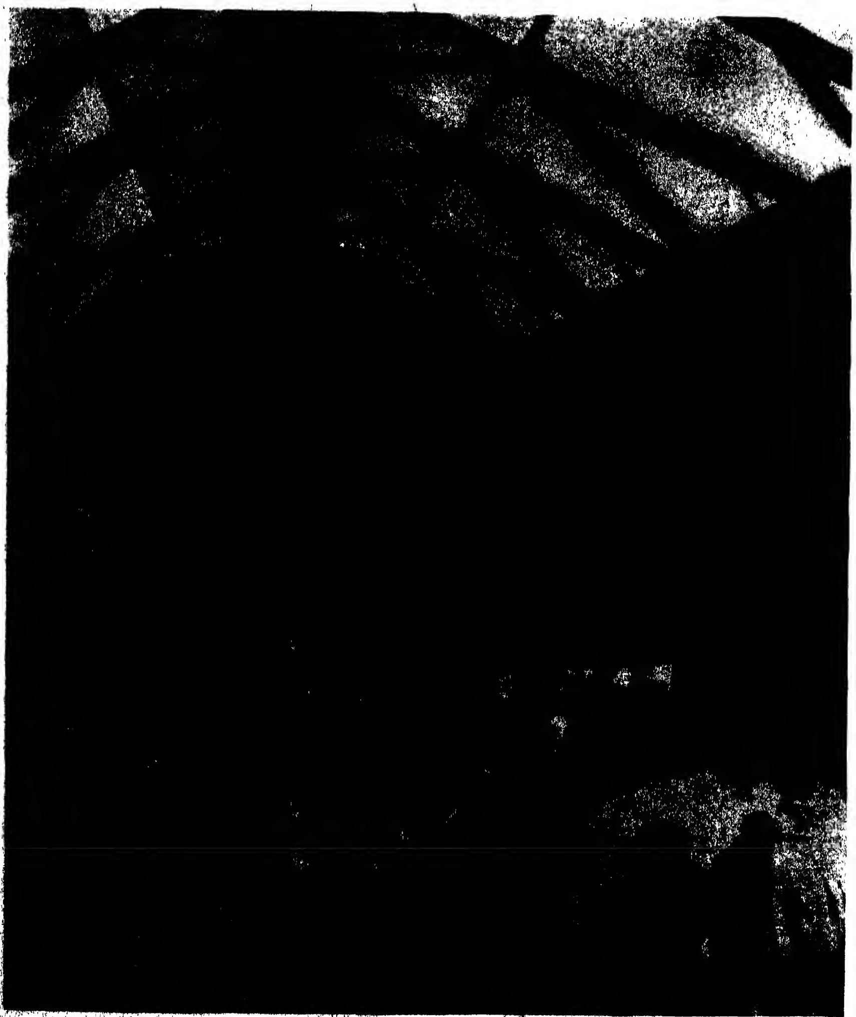
Commenting on Galli's memoir in the *Comptes Rendus*, Comte de Montessus de Ballore, director of the Chilean seismological service, gives an analysis of 135 reports received in connection with the great Chilean earthquake of August 16th, 1906. After this earthquake question blanks were sent to all parts of the country, and among the items of information requested was a report as to the occurrence and character of luminous phenomena. Unfortunately for the particular object in question, severe thunderstorms prevailed in Chile at the time of the earthquake, and a majority of the luminous appearances reported must be attributed to ordinary lightning. The author does not consider the question whether these widespread thunderstorms might be themselves connected in some way with the earthquake.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 4.] ★ NEW YORK, JULY 27, 1912 ★ [10 CENTS A COPY $3.00 A YEAR



SURF-BATHING INDOORS.—[See page [illegible].]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 27, 1912

Published by Munn & Co Incorporated. Charles Allen Munn President
Frederick Converse Beach Secretary and Treasurer
all at 361 Broadway New York

Entered at the Post Office of New York N Y as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3 00
Postage prepaid in United States and possessions Mexico Cuba and Panama	
Subscriptions for Foreign Countries one year postage prepaid	4 50
Subscriptions to Canada one year postage prepaid	3 75

The Scientific American Publications

Scientific American (established 1845)	per year	$3 00
Scientific American Supplement (established 1876)		5 00
American Homes and Gardens		3 00

The combined subscription rates and rates to foreign countries including Canada will be furnished upon application

Remit by postal or express money order bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are sharp, the articles short and the facts authentic the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

The Senate Bill for Safe Ships

THE bill introduced in the Senate by Senator William Alden Smith who conducted the Titanic inquiry commends itself to the serious consideration of the owners and builders of ocean going steamships and the general traveling public

It was inevitable that several bills relating to the subject would be introduced in Congress Some of these call for measures which are impracticable but the bill of Senator Smith shows that whatever criticisms may have been made of his methods of conducting the Titanic inquiry he has very clearly learned the lessons of the great disaster both as to the causes which led to it and the remedial measures which must be taken to prevent its possible recurrence

The SCIENTIFIC AMERICAN has claimed from the very first that the most important lesson taught by the disaster was that present methods of constructing large ocean going steamships do not make adequate provision to protect their flotation in the event of collision So far as her strength was concerned the Titanic was a most excellently constructed ship The great defect in this vessel and in at least 95 per cent of the merchant ships afloat to-day is that the provisions against sinking such as bulkheads water tight decks and the double skin are altogether too few and such as exist are insufficiently worked out

Therefore we are glad to note that the Smith bill calls for the inclusion in ocean and coastwise steam vessels of certain safety elements designed to protect the flotation which as we have shown in these columns would have saved the Titanic had they been present within the structure of that ship If the bill becomes law it will be necessary for every steel ocean or coastwise sea going steam vessel and every steel steam vessel navigating the Great Lakes carrying one hundred or more passengers to have a water tight skin inboard of the outside plating This skin must extend not less than 10 per cent of the load draft above the full load water line either as an extension of the inner bottom plating or in the form of longitudinal water tight bulkheads and it must reach from the forward collision bulkhead over not less than two thirds of the length of the vessel

The transverse bulkheads are to be so spaced that any two adjacent compartments of the vessel may be flooded without destroying its floatability or stability We could wish that the bill read any three adjacent compartments for it is certainly conceivable that collision with another ship or a long tearing wound such as that received by the Titanic whether through the side plating or through the double bottom might fill at least three compartments

The transverse bulkheads forward and abaft of the machinery spaces are to be continued water tight vertically to the uppermost continuous structural deck and this deck is to be fitted water tight Bulkheads within the limits of the machinery spaces must extend not less than 25 per cent of the draft of the vessel above the load water line and they must end at a water tight deck

Applying the foregoing regulations to the Titanic it would mean that the first four and the last three bulkheads would be carried up to the shelter deck about 40 feet above the water line and the bulkheads throughout the engine and the boiler room spaces would be carried to the upper deck to a height of about 10 feet above the water level

Finally all water tight bulkheads and decks must be proportioned to withstand, without material permanent deflection, a water pressure equal to five feet more than the full height of the bulkhead. Bulkheads of novel dimensions or scantling are to be tested by actual water pressure. The bill would be improved if this read that all bulkheads before being passed by the surveyors should be tested by actual water pressure

The bill as we have said, makes excellent provision for safeguarding the flotation of future ships. We suggest, however, that it would be much improved if a clause were added stating that all openings leading from the boiler and engine rooms and the holds to the shelter deck must be inclosed in steel water-tight trunks, or casings. This provision should be so worded as to apply to openings for boiler uptakes, ventilating shafts ladders and cargo hatches. The provision of such casings would prevent water, which might enter the ship below the water line, from rising above the water tight deck and flooding the decks above.

The Royal Society

ALMOST every eminent Englishman seems at some time to have tossed into a hat a handful or so of that form of carbohydrate food used in the making of "alphabet soup" to have taken out at random, just as from a church fair "grab bag,' a number of these letters and have suffixed them in a long string to his natal and baptismal cognomina. Among these seemingly adventitious combinations the most highly prized by Englishmen of science is that denoting fellowship in the Royal Society of London for Improving Natural Knowledge This superb institution—when time presses called simply the Royal Society—on the 15th of July celebrated its 250th anniversary It was founded by Charles II, of otherwise rather nebulous memory, and all his male successors on the British throne have been members, including the present King, who evinces a very active interest in its welfare and in its beneficent deliberations

Representatives of the French Academy, which Cardinal Richelieu founded only a few years before the Royal Society, attended the anniversary celebration The Society seems to have been originated, not by an Englishman, but by a German—Theodore Haak, who came from the Rhine Palatinate and instituted in 1645 weekly meetings 'of divers worthy persons inquisitive in natural philosophy and other parts of human learning, and particularly of what has been called the new philosophy, or experimental philosophy," and another German, Heinrich Oldenberg, was the first secretary Three years later a sister organization, the Philosophical Society of Oxford, was founded in that university A most friendly intercourse was maintained until, in 1660, under the chairmanship of Dr Wilkins, their activities were joined in a metropolitan corporation for promoting 'physico-mathematical, experimental learning and philosophy" Sir Robert Moray was the first president, and among others have been Newton and Lister Several great Americans have been or are fellows—Benjamin Franklin, Benjamin Thompson (Count Rumford), Alexander Agassiz, Simon Newcomb, Dr S Weir Mitchell

The membership has from the beginning been limited to fifty-five, most of these famous men have ever been and are advanced in years on joining the Society, such fellowship meaning to them the crowning point of a career devoted to science And there are fifty honorary foreign members, without power and selected by the council from among men eminent in science abroad. The annual election of officers is held on the day of the Society's spiritual patron, St Andrew It receives from the British Government an annual grant of £5,000 A report on its considerable trust funds and its other sources of revenue is published annually Its expenditures are for the public weal, every year thousands of pounds are devoted to the promotion of scientific research, and to paying for the experimental work of scientists who personally lack the means Through its long and most honorable existence, it has ever been the principal advisor of the State and Crown in all matters of science It is officially represented on the governing body of every kind of governmental and semi-public scientific and other educational institution Its counsel is sought and given on matters innumerable. It keeps ever in touch with learned societies throughout the world.

It has the custody of the standard copies of the Imperial Standard yard and pound, it controls the National Physical Laboratory, which was established by the Government on its recommendation; it superintends the Kew and the Greenwich observatories, on its initiative, and by its advice, the Government inaugurated the geodetic survey in 1791 Other enterprises which have had the Society's aid are the expedition of Capt Cook to observe the transit of Venus, and that great commander's circumnavigation of the globe; the various Arctic expeditions under Ross, Parry, Franklin, and Nares, the "Challenger" expedition; the International Congresses on the questions of a prime meridian, and of an international seismological investigation system, tidal observations, protection of buildings from lightning; tropical diseases, color-blindness; and much else impossible of enumeration.

The Conquest of Disease

THE Health Department of New York is to be congratulated upon the [illegible] rate in New York from [illegible] the forty-six years covering the period since the department was organized. In the year [illegible] the death rate ratio was 36.31 per each thousand of population. To-day the ratio is 15.13 per thousand.

Well may the report say "The facts are significant. They show in an unmistakable manner the success of public sanitary administration which has directed its efforts almost entirely against infectious diseases."

Peace hath its victories—and surely this successful conquest of disease is one of the greatest of them. Our satisfaction in contemplating a reduction of over 50 per cent in the death rate of New York, our admiration for those thoughtful, highly intelligent and always industrious men who, in the quiet of the laboratory, have been carrying on the fight against disease, becomes the greater when we remember that what has been done in this city has been done also in a hundred others

A reduction of over 50 per cent in less than fifty years in the death rate justifies, surely, the hope that before another fifty years has passed science will have obtained a complete mastery of infectious diseases, and mankind, once the prey of superstition and a predisposing dread, will have realized that, if certain simple salutary laws are followed, it can live its day-by-day life free from all fear, even of the great white plague itself.

Certain diseases there are which to-day remain unconquered, chief among which is the last-named. Yet even these are gradually being brought under control, and the progress in bacteriology, particularly during the past decade, has been such that, even in the laboratories (where predictions are never made) one can detect a note of strong hopefulness that consumption and the few other of the diseases which have hitherto stubbornly withheld their secrets, will be brought within absolute control

It is an amazing fact that the very methods by which the bacteriologist has achieved his wonderful success are being bitterly attacked. Had it not been for the practice of vivisection, this 50 per cent reduction in the death rate could never have been accomplished So far from the bacteriological investigations which have been made in the laboratories of this and other cities being marked by needless cruelty, the discomfort or pain which may have been suffered by a certain few dumb animals has brought untold benefit and relief.

The Exiles of the South Orkneys

THE heroism of the cosmopolitan group of scientific men that keeps in operation the Argentine meteorological station in the South Orkneys attracts surprisingly little attention, even from the scientific public The station was originally established by the Scottish Antarctic Expedition of 1902-04 and was taken over in 1904 by the Argentine Meteorological Office Every year a party of four—three observers and a cook—is sent out from Buenos Aires to spend a year of exile in this inhospitable spot, which, although north of the Antarctic circle (lat. 60 deg. 40 min), is generally ice bound, and has a truly polar climate. The mean annual temperature is 23.8 deg. Fahr The snowfall is excessive, sunshine is rare, and strong gales are frequent. Moss and lichens are the only vegetation.

From a purely scientific point of view, the study of the winds and barometric pressure distribution of the Antarctic is peculiarly interesting on account of its comparative simplicity The South Pole lies at about the center of a dome-shaped continental glacier, so that the wind-system belonging to the planetary circulation and that due to air drainage down the glacier slopes are approximately concentric.

It is urgently desirable that other fixed and permanent meteorological stations should be established in the south polar regions. Pending this consummation, the enlightened policy of the Argentine government in maintaining a station in the South Orkneys, at a cost of from $20,000 to $25,000 a year, is most commendable. Special praise, however, is due to the devoted men, of several nationalities—Scotch, American, and others—who are unobtrusively carrying out this important undertaking, with all the hardships it involves They richly deserve the tribute paid to them by M. Rouch, of Dr. Charcot's last Antarctic expedition, in a recent address before the Société Météorologique de France:

"There, for a year, in a primitive house, amid continual storms, never sure of the return of the ship, which, in order to reach them, must sometimes penetrate a difficult ice pack, they lead the traditional existence of a polar winter sojourn; obliged to bear every drudgery and to endure a rigorous climate. They do not call themselves polar explorers, and on their return to civilization they do not go about the world delivering lectures—hence they are unknown. [illegible] that I pay this tribute of my admiration to these men"

Engineering

New French Dreadnoughts.—The French navy is following the lead of Great Britain and the United States by increasing the caliber and reducing the number of guns in her main batteries. The three new battleships, the "Lorraine," the "Bretagne," and "Provence," of 23,500 tons, will carry ten 13.5-inch guns, all placed on the longitudinal center line of the ship.

The Largest Warship.—Although authorities differ as to the dimensions of the recently-launched British battle-cruiser "Queen Mary," there seems little reason to doubt that she is the largest warship afloat at the present time. Some authorities give her dimensions as follows: Length over all, 725 feet; beam, 87 feet; and displacement, 29,000 tons. She will probably make over 30 knots on trial, and to do this her turbines will have to develop not far short of 100,000 horse-power. The "Moltke," of 23,500 tons approximate displacement, required 90,000 horse-power to drive her at from 29 to 29½ knots.

Thirty Miles of Warships.—Great Britain has been the scene of some remarkable naval mobilizations, of which, until this summer, the most notable was that held during the coronation festivities last year. In point of size, however, that review was surpassed by the one held at Spithead last month, when 239 warships, big and little, were drawn up in six parallel lines, which, if strung out in single line, would have extended for 30 miles. The significance of this display will be appreciated when it is remembered that Great Britain is building warships at a faster rate, and is building more of them, than at any period in the history of her navy.

Scouting by Submarine Bell.—Four of our naval submarines, using the submarine bell as the only source of communication, recently went in search of the "Castine," which represented an enemy's ship. The submarines maneuvered in depths of from 20 to 60 feet, and finally the "Castine" was found and theoretically sunk by four torpedoes provided with dummy heads, which were successfully discharged at the ship. It may be mentioned that the submarine bell affords effective protection against collision, since the throb of the engines of an approaching ship can be distinctly heard when the submarine is below the water.

"Titanic" Inquiry Concluded.—The Board of Trade inquiry into the "Titanic" disaster has been concluded, and its President, Lord Mersey, has announced that its report will be produced "within a reasonable time." The Attorney-General referred to the inaction of Capt. Lord, of the "Californian," and said that he had come to the conclusion that there was no excuse to be found for his conduct on that night when, as the evidence showed, his ship might have reached the "Titanic" in time to save the whole of her passengers. He asserted that utterly unnecessary risks had been taken by the "Titanic," and that the causes of the disaster were a bad lookout and excessive speed.

A 32-knot Steam Yacht.—The turbine yacht "Winchester," built for P. W. Rouss, Esq., of New York, by Yarrow & Co., under the supervision of Cox & Stevens, naval architects, New York, ran her full speed trials recently on the Skelmorlie deep water measured mile, attaining a mean speed of 32¼ knots. This was a quarter of a knot in excess of the contract speed. The "Winchester" is 205 feet in length and 18 feet 6 inches in breadth, and the trials prove her to be one of the fastest yachts afloat. The propelling machinery consists of Parsons turbines, driving two shafts, and steam is supplied by two of the firm's water-tube boilers fired with oil fuel.

Hydraulic Transmission for Diesel Motors.—The Vulcan Company, of Stettin, are building two Föttinger transformers, capable of delivering 1,200 horse-power, for a vessel to be employed in the Congo trade. It begins to look as though the introduction of Diesel engines on ocean-going ships, particularly those engaged in freight carrying, will produce a widespread demand for an efficient speed-reduction mechanism. Three types are available—the mechanical, the electrical and the hydraulic. The mechanical leads in efficiency, the electrical in the wide range of speed control, and the hydraulic reduction gear, although lower in efficiency than the others, has the advantage of quick reversing, a wide range of speed and great reliability.

Memorial to "Titanic's" Engineers.—One of the most striking instances of devotion to duty in the "Titanic" disaster was that afforded by the engine-room staff. In a sudden emergency, such as overtook this ship, the order for the engineer staff is "all below;" and, judging from the fact that not a single member of the staff of thirty-four, including John Bell, the Chief Engineer, survived the disaster, it is believed that every one of these men remained at his post to the very last and went down with the ship. Engineers the world over are invited to contribute to a Shilling Fund (25 cents) to erect a suitable memorial in Southampton. Contributions will be received in the United States by Mr. H. L. Aldrich, *International Marine Engineering*, 17 Battery Place, New York city.

Aeronautics

Newest Record for Speed.—Vedrines traveled for two hours at a speed of one hundred and six miles an hour at Rheims, on July 18th. He broke all records.

The Wright Hydro-aeroplane School.—Orville Wright has decided to open a station at Glen Head, L. I., where the use of the hydro-aeroplane is to be taught. The station will be in operation, it is said, on or before August 1st.

The Aeronautic War Fund of France.—According to *Le Temps* the National Committee for Military Aviation has collected the sum of 1,280,373 francs for aviation purposes. The National Committee has already turned over to the Ministry of War the sum of 500,000 francs for the purchase of thirty-three aeroplanes.

A Hydro-aero Bus.—Roger Sommer has built a hydro-aeroplane which is to carry six passengers. The machine is to be used on Lake Geneva. Tickets will be sold to tourists. The maximum speed is to be only forty-five miles an hour. Daily circuits are to be made from town to town around the lake.

Japan Buys Aeroplanes in America.—It has been announced at the office of Glenn H. Curtiss that the Imperial Japanese Navy has placed an order for three hydro-aeroplanes, and that three Japanese Navy officers are now on their way to Hammondsport, where they will be taught to fly the machines.

A Glenn Curtiss Launching Machine.—Glenn Curtiss, the well-known aviator, has secured a patent (No 1,027,242) for a means for launching flying machines, which comprises a suitable mount with an aeroplane supporting device pivoted upon it, in connection with which he provides means for imparting at a variable speed an angular throw to the supporting device so that the machine is brought to a position after it has attained a maximum velocity which position is according to the proposed direction of flight.

Aeroplane Fleets for Argentina and Roumania.—The recent popular movement in Italy whereby the army of that country became possessed of a fine fleet of aeroplanes has had parallels in Argentina and Roumania. It is reported that the Sociedad Sportiva Argentina has offered the Minister of War an aerial fleet, the cost of which will be defrayed by the sale to the public of 1,500,000 illustrated postcards. A competition was recently held to obtain suitable designs for the cards, viz., allegorical representations of the military uses of aviation. An Aerial League has been formed in Bucharest for the purpose of raising funds by popular subscription with which to buy aeroplanes for the Roumanian army.

Do Flying-fish Fly?—This much-mooted question is discussed by William Allingham in the *Nautical Magazine* The orthodox scientific opinion is that the "wings" of the flying-fish merely serve as a parachute to sustain the fish for a brief period in the air, after he has launched himself out of the water by a powerful screw-like movement of his tail. According to this view, the fish has no power of directing his flight after he has left the water However, Mr. Allingham, who is a nautical expert attached to the British Meteorological Office and is in constant intercourse with seamen, reports many observations that tend to controvert this opinion. Certain observers claim that the wing-fins are in constant rapid vibration, and seem actually to serve the purpose of flight. One vessel master watched a fish that had attained an altitude of 20 feet above the water, and was flying toward the mizzen rigging of his ship when, apparently noticing the obstruction, it changed its course about 60 degrees, crossing the vessel's stern to regain the water. Many other similar observations are mentioned. A series of cinematograph pictures might solve this question once and for all.

Death of Hubert Latham.—Hubert Latham, one of the pioneer aviators, was killed by a buffalo on June 7th in a hunt in the French Soudan. He was one of the few men who first took up aviation and who was still flying almost up to the time of his death. The rest have either been killed or have gone into the safer vocation of manufacturing. Latham took up flying very soon after Wilbur Wright made his demonstrations in France. He always flew an Antoinette monoplane. He had not been flying many months before he decided to cross the Channel. His first attempt was made on July 19th, 1909. He flew half-way across and then fell into the sea and was picked up by a French torpedo boat. After Blériot had performed the feat, Latham made a second attempt on July 27th, covering nineteen of the twenty-two miles. Just off Dover he again fell into the Channel. Latham was phenomenally lucky. He emerged time and time again from accidents without serious personal injury, although he smashed machine after machine. In his day he was a record breaker. He held records for endurance, height and speed, all of which, however, have since been broken. Americans will remember him as one of the contestants on the French team that competed at Belmont Park in 1910.

Automobiles

When Kerosene is Useful.—A motorist from Marion, N. Y., the other day was caught miles away from a garage, without a drop of gasoline on which to get home. Inquiry at farm houses nearby failed to reveal any available supply of the "precious fluid," and so he decided to try a can of kerosene. As the motor was still warm, he had no difficulty at all in starting it and finishing his run home without further trouble.

Folding Chairs of Pressed Steel.—Folding chairs made of pressed steel, which can be folded together so as to look like an ordinary music holder, and slipped into a cover, are the latest in the accessory business. Although the weight of the chair is but thirty ounces, it is built strong enough to support a man weighing four hundred pounds

Nickel Trimmings Now Popular.—A large proportion of the 1913 output of the American automobile companies will have nickel trimmings The beauty and durability of nickel, and the ease with which it is kept bright, commend its more general use. At any rate, it is a tasteful compromise between the brilliance of burnished brass and dull effects of the more utilitarian finishes, such as gun metal

Subsidizing Motor Cars.—The British War Office has drawn up a provisional scheme for subsidizing "petrol motor lorries" (i. e., gasoline trucks built for carrying heavy loads) built after January 1st, 1910, and owned by civilians. The owners are to receive an initial subsidy varying from $39 to $58, and an annual subsidy of $73, in return for which they are to agree to turn over their wagons to the government in case of war, at a fixed price.

Reinforced Bulb Horns.—Because the ordinary bulbs used on automobile horns have invariably been a source of trouble and annoyance to the motorist, and because the various mechanical horns are making such a remarkable progress, a French horn maker has brought out a reinforced bulb for the ordinary reed horn, which has several unusual features. Instead of being smooth and slippery, the new bulb is ribbed horizontally and vertically, affording a good grip to the fingers and strengthening it to such an extent that it will outlast three ordinary bulbs.

Race Victories and Sales.—The public, of course, well knows that race victories influence to a certain extent the sales of cars, particularly of those of the "roadster" type But it must come as a distinct surprise to hear of a German factory which by good judgment and good luck managed to win three successive road races and one reliability tour, whereupon it received a cable order from England for no less than eight hundred chassis of the winning type. Previous to the winning of these races the entire output of the factory amounted to only one thousand cars.

Dual Wheels for Heavy Cars.—Instead of mounting dual rubber tires on a wide-rimmed wheel, for use on heavy-duty trucks, a New York tire expert has invented a dual wheel, which is said to have shown great efficiency in the trying-out process The wheels are staggered, one spindle being in front of and the other behind the line of the axle The spindles are connected by means of an equalizing bar, which permits the wheels to follow the contour of the road and equally divides the load between them. While the wheel is to be made in New York by a well-known rim manufacturer, it is based on patents which were granted to Molesworth, the British scientist The invention was improved and developed by Alexander Dow.

Emergency Steering Device.—Many of the most serious accidents in fast driving, and especially in racing, arise from the breaking of the steering knuckle and the subsequent swerving of the front wheels. A Rochester mechanic has patented a device which is designed to prevent the swerving of the wheels in the event of a fracture of the steering gear. The device is practically a double steering gear, operating independently. The main gear is attached to the machine and the second gear can be put on if desired. The former operates on a knuckle joint, while the latter acts directly on the wheels. A steering post is fastened directly beneath the steering wheel, and operates on a worm screw connected with rods on which are bolted collars set in a flange bolted to the wheels. The flanges are constructed so the collar rests in them and runs on ball bearings, the two wheels being connected by rods across the front of the machine, in addition to the usual tie rods. If the main gear breaks, the rods hold the wheels from swerving and steer as if nothing had happened. If one of the rods of the device breaks, the other will do the work. If a nut comes off one of the wheels, the flanges and collars will tend to prevent the whole from coming off, and even if the axle should break, the device will do its share toward preventing a bad smash-up; the machine will rest on the rods and give the driver a chance to come to a stop without turning a somersault.

Fig. 1. A Central American Indian woman, a white boy and a negro photographed with ordinary light.

Fig. 2.—The same subjects photographed with invisible ultra-violet light.

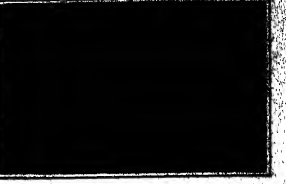


Fig. 3.—This photograph was made with infra-red light.

Black and White Men in Invisible Light

Tricks Played by Ultra-Violet Rays

By Gustave Michaud and Fidel Tristan, Costa Rica State College

SEVERAL hypotheses have been advanced to explain the difference in color between the southern and northern races of mankind. None is entirely satisfactory. It occurred to the writers that some progress might perhaps be made toward the solution of the problem if the relative absorption of light by the white and colored skins was considered not only for the visible radiations, but also for the invisible yet ever-present ultra-violet and infra-red lights.

A group composed of a dark-skinned negro, an Indian woman of a chocolate color with perhaps an admixture of negro blood, and a white boy of Alpine descent was photographed successively in visible light, in infra-red and ultra-violet lights. Foucault's filter (3,100 to 3,200) was used for the ultra-violet, the objective being a quartz lens silvered on both sides. Exposure in full sunlight 3 minutes. For the infra-red, Prof. Wood's filter was slightly modified, the 15-gramme gelatin filter made by Messrs. Wratten and Wainright, of Croydon, England, was placed between two disks of cobalt glass of the darkest shade used by oculists. The spectrum panchromatic plates, sensitive to the infra-red, and made by the above named firm, gave a tolerably good image with an exposure of 7 minutes.

The result was of a somewhat unexpected and confusing nature and is clearly told by the accompanying three photographs. The difference in the absorbing power of the black and white skins decreases from the infra-red to the ultra-violet. In the infra-red it is by far greater than in visible light. In the ultra-violet it is almost *nil*. Indeed, it may be said that, if our eyes were sensitive to ultra-violet light only, all men would be negroes, so far as color is concerned.

Some years ago, one of the writers (SCIENTIFIC AMERICAN, November 5th, 1904) ventured to explain the genesis of the white races of men through a process similar to that which bleached the fur of most northern animals which hunt or are hunted. During the whole Paleolithic and great part of the Neolithic ages, man was ignorant of agriculture. In Abbeville, in Spy, in Mentone, in Hoxne, in the caves of Périgord, numberless flint or bone implements were found which prove that fact. The Paleolithic man was a hunter, and this being recognized, it becomes easier to explain how his color was changed, like that of other northward-migrating carnivora, than to explain the reason why he should have been an exception to the general rule. Primitive tribes were probably often decimated by hunger, as the Canadian Indians of to-day. Those hunters who exhibited on the snow a sallow face, black hair, beard and eyes worked at a disadvantage when compared with somewhat lighter-complexioned comrades. They were more conspicuous on the white field, and could not so easily approach their prey within striking distance. When food was scarce, mortality was the greatest in their families; the lighter-complexioned individuals leaving in every generation the larger posterity. If that explanation holds good, it is rather easy to understand the reason why the selective process which decreased the absorption of visible light by the skin had no such influence on the invisible ultra-violet light. Why and how the same process should have deprived the white skin of the power of absorbing the warm and invisible infra-red radiations is by far more difficult to understand. It seems that such radiations are needed above all by the man who must withstand the effects of a cold climate. Yet the negro is the man whose skin is so organized that it can absorb them.

"Heart Stopping" as a Profession

Examples of Muscular Control of Scientific Interest

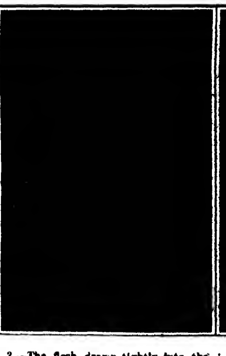
By John B. Huber, A.M., M.D.

A MAN recently exhibited himself in London, who, according to an imaginative press-agent, gave "an extraordinary demonstration of phenomenal muscle manipulation and stopping the beating of the heart," before members of the medical profession in London. I cannot find, however, any report of this demonstration. The press agent states that "by years of hard work, careful study and immense concentration of mind," the athlete in question "can manipulate his muscles to an extent never before deemed possible in medical history." Many men have by exercises developed enormous muscles, but they have been invisible and remained firm to the touch even when relaxed. But this athlete can relax his muscles to such an extent that "by shaking his arm he can make the triceps quiver like reeds shaken by the wind." More than this, he can stop the beating of his heart for more than twenty seconds, and retard or accelerate his pulse at will, thereby defying the laws of nature. There is no authentic case of this feat ever having been accomplished before. In the second of the photographs here published the flesh has been drawn tightly into the throat and up under the under jaws, by muscular contraction, "all being as solid as a block of marble." In another the muscles of the neck are made distinct. Still another shows unusual manipulation of the abdomen. The athlete "can draw in his stomach to an extraordinary degree and also protrude it as much in the opposite direction."

It is also claimed that this performer can remain under water from six to eight minutes, and that he can live for a protracted time when buried in the ground.

(Continued on page 85.)

1.—The athlete's body in repose.



2.—The flesh drawn tightly into the throat by muscular contraction.

3.—Appearance of a curtain produced by muscular control.

4.—The abdominal muscles contracted [illegible] concavity.

The "Commonwealth"-"New Hampshire" Collision

The Bulkhead and the Watertight Deck Prove Their Value

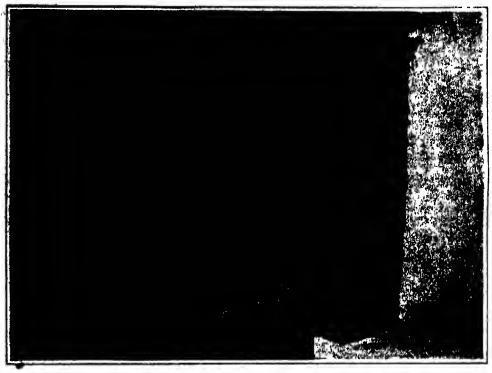
IT would be difficult to find a better example of theory borne out by actual practice than occurred in the recent accident to the U. S. S. "New Hampshire" when run into by the Fall River Line steamer "Commonwealth."

The accident occurred in Newport harbor about 5 A. M. on the morning of July 7th. The battleship "New Hampshire," displacement 16,000 tons, was lying at anchor in a heavy fog, when the "Commonwealth," one of the most palatial of modern steamers, with a displacement of about 4,500 tons, rammed the stern of the battleship at a point about six feet to starboard of the center line. Chance could hardly have chosen a better point for the collision to occur, for, in spite of the fact that the "New Hampshire's" full crew was about 750 men and the "Commonwealth" was probably carrying an equal number of people, not a single fatality or injury of any kind resulted.

The general extent of the damage to each vessel can be observed roughly by referring to the two photographs, and it will be seen that as usual the body receiving the blow has suffered considerably more damage than the body inflicting the blow. At first sight, it would seem that Newton's law of motion, "Action and reaction are equal and opposite in direction," is not evidenced here. Just here though the point is frequently overlooked, that in addition to the structural damage to the "Commonwealth," *the speed of her great mass was reduced almost immediately to zero*, and it is this consideration that brings the theory and practice in accord. Some idea of the force of such a blow can be approximated from the following calculation. In the absence of any definite information on the subject, assuming a speed of 15 feet per second (corresponding to slightly over eight knots per hour, which is considerably less than half speed for the "Commonwealth"), and a displacement of 4,500 tons, we find that the energy of the blow which she delivered against the "New Hampshire" was about 16,000 foot-tons. This would be sufficient to lift the battleship one foot into the air.

In considering the relative effects of such a collision on the two vessels it is to be remembered that the "New Hampshire" received the blow practically *broadside on*, so that her plating acted merely as a thin membrane for holding together the framing, and except in assisting to transmit the stress to the framing the plating itself could not be expected to contribute any material resistance to the blow. The "Commonwealth," on the contrary, delivered the blow with her knife-like bow armored with its steel stem, and her plating received the impact *edge on*, so to speak, and in the most advantageous way possible to enable the plating not only to transmit the stress to the framing, but also to take its full proportion of such stress.

An examination of the stern of the "New Hampshire" by our representative disclosed the fact that she had withstood the enormous impact remarkably well. One could not desire a better tribute either to the quality of the product of our steel manufacturers or to the careful and efficient inspection of every piece of material entering into the hull of such a vessel by the representatives of the Navy Department, than was given by a view of the tangled and distorted mass of twisted plating and shapes.



Bow of the "Commonwealth," showing how the steel protective deck of the battleship cut deeply into the bow structure

The protective deck of the "New Hampshire," upon which the seaman is standing, is intact. The lighter structure above was torn loose and driven into the ship.

The outside shell plating, ⅝ inch in thickness, from main deck to water line was bent inboard in a wedge-shaped section corresponding somewhat with the shape of the "Commonwealth's" bow. The point of impact at the rail of the main deck had been bodily carried forward a distance of over twenty feet, and, as can be seen from the photograph, shows no sign of cracking or rupture throughout the twenty feet of height between the protective and main deck. The rivets, too, have apparently held well, showing surprisingly few heads snapped off. At the protective deck, 1½ inches thick, which on this vessel comes slightly below her water line, the plating and frames have been sheared off, leaving the flat top of the heavy watertight protective deck intact, and as good as the day it was originally installed. There was apparently no damage whatever below the protective deck, which is only another excellent example of the great advantages to be gained either in warship or merchant construction of a heavy watertight deck at or near the water line. The presence of this deck slightly below the water line and its absolute intactness prevented practically any water at all from entering the ship.

The plating of the gun and berth decks has been considerably buckled and torn, and the four or five after beams and frames on both sides were so badly twisted as to require renewal. On the main deck the plating and beams were badly bent, and the wood deck torn and shattered.

The compartments involved were the extreme after cabin of the commanding officer, the bath and shower room for the wardroom officers, and the after staterooms on each side. In these spaces all fresh and salt water piping, ventilation ducts, steam pipes, electric light fixtures, wiring and conduit, tiling, etc., were completely wrecked, together with a number of fittings, such as airports, gunport shutters, deck stanchions, flagstaff, etc.

Several of the 2-inch nickel-steel plates of armor protecting the after 6-pounder guns were bent through an angle of about 125 degrees, but gave no evidence of cracking, and the authorities expressed the belief that these could be heated, straightened and used again. One heavier 3-inch plate of armor at the water line showed evidence of having been slightly bent in one corner, but no further injury was received by the water-line armor.

There was apparently no damage done to the propellers, shafting or rudder, which can only be considered a piece of very good fortune.

The repairs to the stern, which must be done with the vessel in dock, will probably be executed by cutting off the whole damaged portion above the protective deck by the use of pneumatic chipping hammers, and the oxy-acetylene flame and lifting it bodily off. This portion will then be replaced by a whole new stern, fitted complete in all respects, which will require an expenditure of about $15,000 and six weeks time.

The damage to the "Commonwealth," which it is also estimated will cost about $15,000 to repair, consisted of a broken stem and a very badly crumpled and twisted bow, which will involve the renewal of a large number of her forward plates and frames, and will necessitate docking the vessel. The injury sustained by this vessel shows the great value of efficient collision bulkheads, which held perfectly in this case. The knife-like effect of the armored protective deck of the battleship in shearing the shell plating and forward frames of the "Commonwealth" is plainly visible in the illustration.

The most gratifying thing about the accident, if indeed anything can be said to be gratifying about such an unfortunate occurrence, was the perfect order and discipline observed on both vessels immediately after the collision. In spite of the heavy fog that prevailed, and the fact that, except for those immediately on

(Concluded on page 87.)

Artificial Surf Baths

A Miniature Indoor Ocean

PROBABLY no feature of the International Hygiene Exposition held in Dresden last year attracted more general interest than the Undosa artificial surf bath. The receipts from the sale of bath tickets, and especially of spectators' tickets, were unexpectedly large, amounting sometimes to $450 in a single day. As the cost of operation was only about $40 per day, it is evident that the artificial surf bath may be made a very profitable as well as a very beneficial institution.

The idea of generating waves in still water by alternately submerging and withdrawing solid bodies of appropriate form and dimension, originated with Hofrat Hoeglauer of Munich, who in 1903 obtained a German patent for a wave-producing apparatus, which was subsequently patented in the United States and many other countries. The first experiment in the production of an artificial surf bath by this method was made in 1905 in a concrete basin built in Lake Stamberg.

The bath could be used only in summer, and, although it was very well patronized on clear hot days, it was evident that long periods of fine summer weather would be required in order to pay the operating expenses and provide for amortization and fair interest on the initial outlay.

It was left for the Dresden Hygienic Exposition to demonstrate that artificial surf baths can be made profitable by constructing them in such a manner that they can be used throughout the year in all sorts of weather. The directors of the Exposition had decided that the department of sport would not be complete without a large swimming bath in which swimming races could be conducted. The constructor of the bath, Herr Heckmagel, suggested that it be provided with a removable roof, and also with apparatus for producing artificial surf. This plan was finally adopted after much discussion and with grave financial misgivings, and the result surpassed all expectations. During the five months of its operation the bath was visited by nearly half a million persons and earned about $30,000, which more than covered the cost of construction ($20,000), and the operating expenses (about $7,000). The cost of construction was diminished about one-half by the gratuitous contribution of many parts of the equipment by exhibitors, and the site cost nothing, but it appears probable that a similar enterprise would pay very well in normal conditions. The additional outlay for the wave-producing apparatus would not exceed $7,000.

The mechanical device by which the waves are produced is very simple in principle. It consists essentially of one or more hollow wedge-shaped bodies made of sheet iron, which are rhythmically immersed in and drawn out of the water by appropriate machinery. In situations in which the vertical elevation and depression of the wedges present difficulties the waves may be generated by oscillating vanes, but the operation is always so conducted that the water which rushes in to fill the void produced by the elevation of the wedge or the retraction of the vane passes the point of equilibrium and is heaped up by the return swing of the vane or the immersion of the wedge. The wave-forming action, therefore, is identical in principle with that of a stone thrown into a pond. If the stone falls close to the bank, so that the water can escape in only one direction, the height of the resultant waves is increased.

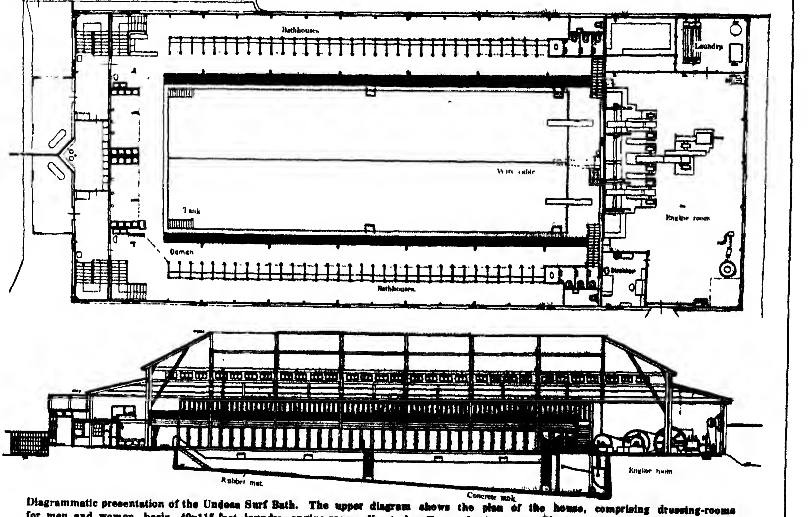
In the experimental plant in Lake Stamberg the waves were generated by three immersion wedges arranged in a straight line, each of which was driven by a separate electric motor, in order to save space. Each motor was coupled directly to a flywheel. When the motor, running without load, had attained the proper speed of rotation, the motor shaft was connected by a worm drive with a horizontal shaft carrying a crank from the end of which the wedge-shaped plunger was suspended. In designing the artificial surf bath at the Dresden Exposition steam was chosen as the motive power in order that the water of the bath and the air of the bathhouse might be heated by the exhaust steam. At first the steam was supplied by the general power house of the Exposition, about 1,000 feet distant, but subsequently a locomotive boiler of 100 horse-power was installed in the bathhouse.

The wave-generating plungers were suspended from cranks attached to a shaft extending across one end of the swimming tank, which was about 40 feet wide and 115 feet long. This shaft could be connected by belt wheels and clutches near its ends, with a counter-shaft at the middle of which was a wheel driven by a belt from the engine shaft. The gearing was constructed to immerse the plungers 18 times per minute when the engine was running at its normal rate of 125 revolutions per minute. The bottom of the basin was inclined in the usual manner, and the plungers were placed at its lower end, where the depth of water was about 7 feet. The waves generated at this end of the basin were more than 3 feet in height, and as they moved toward the other end and reached a point where the depth of water was less than their height they began to comb and break, and thus produced a very good imitation of the surf of a natural sea beach.

The arrangement of the plungers or vanes, and the character of the impulse impressed upon the water, can be varied in divers ways. Where space is limited, for example, a plunger could be attached directly to the piston rod of a vertical engine placed above it, as in one form of steam hammer. Plungers could be operated in the middle of a long basin so as to send waves toward both ends. The two parts of such a basin, divided by the machinery and a screen, could be used as separate baths for men and for women.

The height of the waves is conditioned by the volume of water displaced, and it can be varied within wide limits by varying either the travel of the plungers or the depth of water. For artificial basins the best practical method consists in varying the travel and distributing several plungers across the deep end of the basin. With three plungers constructed to be operated separately a great diversity of wave motion can be produced by using one plunger, two, or all three. If the three plungers, properly distributed, are operated together and synchronously, the whole basin is filled with regular waves of uniform height; while if even one plunger remains idle, the waves generated by the others spread into the calm water in front of it, and thus lose force and height as they approach the farther end. By accelerating or retarding individual plungers it is possible, as observation has shown, to produce a very complex wave pattern resembling that of the open sea.

Practically all of the conditions presented by a natural beach can be reproduced by doing away with the vertical wall at the shallow end of the basin and extending the inclined floor well beyond the water line. The difficult art of swimming in rough water can be practised at one end of the basin, while at the other end bathers can enjoy the breakers, the outrunners of which furnish safe amusement for small children. All of these persons may derive benefit from the massage effected by the moving water.



Diagrammatic presentation of the Undosa Surf Bath. The upper diagram shows the plan of the house, comprising dressing-rooms for men and women, basin, 40x115 feet, laundry, engine-room, director's office and wire rope. The lower shows a longitudinal vertical section of the same, with position of rubber mat, inclined concrete floor, engine-room and canvas roof, opened by rolling up.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The "Hawke"-"Olympic" Collision

To the Editor of the SCIENTIFIC AMERICAN:

Your article in SUPPLEMENT of February 24th, 1912, page 114, suggests that there are some things that pilots and professors do not know or have never reasoned about. For instance, that when a vessel passes swiftly through the water, and that water is deep, *the greater part of the water that refills the hole where the vessel was, comes from below.* If this was not so, almost everyone falling overboard would be struck by the propeller, which we know is not the case. Unless these conditions, it is safe for vessels in smooth water on parallel courses to range alongside one another and sheer off with ease.

Again, when a vessel passes swiftly through shallow water, she *"smells the bottom;"* that is, *the greater part of the water which refills the hole where she was, comes from the sides.* The water under the bow cannot get to the stern quick enough, so it is piled up ahead of her, as we see when large vessels are passing through the Suez canal; the ship's speed is reduced because she is trying to go stern first from the piled-up water ahead to the low-level water astern, and the rudder becomes more or less useless.

Under these conditions, practical experiment will show that safety for two vessels only lies in a *"very wide berth."*

LAW. HARGRAVE.

A Good Roads Suggestion

To the Editor of the SCIENTIFIC AMERICAN.

Regarding permanent roadways, "good roads," the writer would suggest the building of 16-foot or 20-foot Belgium pavement roads or stone block pavements, with 3 feet in depth curbing 4 or 5 inches thick. This roadway to be placed in the middle of the road, and the balance of the road could be graded or built of earth or crushed rock or of such material as found most available. This stone pavement with a 2-foot rough concrete foundation would last for many years and prove to be cheaper in the long run.

PITTSBURGER.

Pittsburg, Kan.

The Reproduction of Sound

To the Editor of the SCIENTIFIC AMERICAN:

Your Paris correspondent in a recent issue of your paper entertained your readers with the narrative of a supposedly novel method of reproducing sound, consisting in forcing a current of air through an airpervious sound record. If you will look at U. S. patent No. 908,683, you will see that this principle is my invention and dates back six years or more. I inclose a piece of a record such as I used at that time.

Philadelphia, Pa. E. LESCHHRANDT.

The Gyroscopic Action in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

The theory of the correspondent in the April 20th number of your paper, regarding the tendency of a certain flying machine to turn to the left, seems to agree with that I advanced in the March 9th number, but in the interest of truth I would like to say that we are both probably wrong. The solution given by "Canadian Subscriber" in the March 2d number is undoubtedly the correct one.

W. G. BLISH

Niles, Mich.

Mr. Turnbull on the Center of Pressure in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of May 18th, 1912, there is an article describing "The New Eiffel Aerodynamic Laboratory at Auteuil," and in it M. Eiffel is credited with a discovery, concerning the center of pressure of a doubly curved surface, that was really made by Turnbull in 1906.

The paragraph to which I refer in your article states that "M. Eiffel has found, however, that by giving the rear portion of the plane a reverse or upward curve, the movement of the center of pressure is reversed. In other words, when the angle of attack is diminished, the center of pressure travels forward, and only travels backward when the angle of attack is increased. This is a result of great practical importance, as it means that by having planes with a reverse curvature, a considerable degree of inherent longitudinal stability is obtained. For example, if a machine in flight suddenly tends to dive, the diminishing of the angle of attack will cause the center of pressure to move forward, and this will give a stabilizing effect tending to lift the forward part of the plane. On the other hand, if the angle of attack is suddenly increased, the backward movement of the center of pressure will tend to right the machine and not allow it to assume too great an angle."

Now, in an article published in the *Physical Review* in March, 1907 (and reprinted in the SCIENTIFIC AMERICAN SUPPLEMENT of January 30th, 1909) I described the movement of the center of pressure with five different types of planes, and drew most particular attention to the inherent longitudinal stability that could be obtained by the use of the double curvature type (No. IV in my article) having concave front and convex rear portion (on the under side).

In fact, my center of pressure curves, my results and deductions are practically identical to those of Eiffel cited above, and obtained patents in the United States, Great Britain, France, and Canada on the "type IV" surface, on account of its inherent longitudinal stability

While I do not wish to detract from the valuable results Eiffel has given us, concerning many aerodynamical questions, it is only fair to state that, concerning the longitudinal stability of the doubly curved surface, my results antedated those of Eiffel by *fully five years*, as can be very easily verified by consulting the references already given.

W. R. TURNBULL.

A Proposed Solution of the Compulsory License Problem

To the Editor of the SCIENTIFIC AMERICAN.

A number of writers are expressing their disapproval of the compulsory license provision of the patent bill now being considered in Washington.

Could not most of this opposition be appeased if the bill were changed to apply to the purchaser of a patent, and not to the original inventor?

In this way any conflict with the Constitution would be avoided, and the direct object of the authors of the bill just as certainly realized.

The pigeon-holing of patents is not wholly practised for reasons of self-preservation or self-defense, as some would have us believe.

Unquestionably, a vast amount of lawful and beneficial competition is suppressed by this means.

Chicago, Ill. C. W. EISENMANN

[We fear that the suggestion, while good in intention, is impracticable The practice of employing dummy directors for corporations shows how easy it would be to circumvent any such law as that proposed. The inventor would simply be used as a tool by his more powerful assignee.—EDITOR.]

Conserving the Atmosphere

To the Editor of the SCIENTIFIC AMERICAN

While the rapid destruction of our forests and exhaustion of our coal supplies are indeed questions of the uttermost seriousness, I cannot agree with your correspondent, Mr. Thorington Chase (whose letter was published in your issue of May 18th) that the "conservation" of our atmosphere is a matter to cause us the least concern.

True it is that the wonderful increase in the world's industrial activities during the past hundred years, entailing the burning of enormous and rapidly increasing quantities of coal and other fuels, results in throwing off into our atmosphere vast and constantly increasing quantities of carbon dioxide, which, if it were not in some way removed from the air, would in time render human life upon this earth impossible. But just here is where the beautiful balance of nature comes in; for as we increase the burden of carbon dioxide in the atmosphere, we stimulate the growth of plant life, which absorbs the carbon dioxide, "digests" out the carbon, and returns the pure oxygen to the air. In other words, the more carbon dioxide there is in the air, the more rapid and luxuriant will plant growth become, which in turn will return more oxygen to the air. Therefore the only result of artificially increasing the production of carbon dioxide is to stimulate plant growth, and is thus on the whole beneficial to the human race. And further than this, it is not the slowly growing forest trees that are the most efficient purifiers of the atmosphere, but the more rapidly growing annual plants upon which we depend for our food supply.

When your correspondent speaks of the "uncalculated millions" of tons of oxygen which are discarded in slag from our blast furnaces as fixed oxygen, he apparently forgets that any oxygen that goes into the slag does not come from the atmosphere, but from the iron ore itself, where it has already been "fixed" by nature. Practically all our commercial production of iron is from ores which are oxides of iron, containing more fixed oxygen than the resulting slag. Therefore the reduction of such ores tends rather to increase than to decrease the burden of oxygen in the air. True, it comes from the furnace stack as carbon dioxide, but only to be eventually freed from its carbon by plant life.

I would like very much to know upon what information your correspondent bases his statement that "aviators have noticed inexplainable absence of available oxygen in the upper strata of the atmosphere." The presence of an excess of carbon dioxide in the atmosphere could have nothing to do with such a condition, as carbon dioxide is heavier than air, and naturally would lie close to the ground. Of course, the amount of oxygen per cubic yard decreases as we ascend, in the same proportion that the density of the air decreases, but this is surely not "unexplainable."

Philadelphia, Pa. E J D COXE.

Compromise Plan for Upbuilding Our Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN.

Though many views on the subject of the merchant marine have been discussed in the SCIENTIFIC AMERICAN, there is one which I have not seen there, and which I desire to present.

There seem to be three well-defined plans which have been advanced as possible methods of solution of this great economic question. These are ship subsidies, preferential duties, and free ships. Each plan has its merits and demerits, and our problem is to find, if possible, a plan embodying the merits of each system with as few as possible of the defects.

Ship subsidies are distasteful to the American sense of justice, and since subsidies cannot be general, they must constitute more or less of a monopoly. Because of this, and because of the opportunity for graft afforded by direct government assistance to private enterprise, ship subsidies would encounter too much opposition to be applicable.

The chief opposition to preferential duties is, that they would excite similar duties in other countries; but since nearly all governments have some form of public protection already, there should be no reason why America could not do likewise. Another objection is that with preferential duties foreign ships would not be able to compete with the Americans. This is due to Congressman Sulzer's advocacy of a five per cent difference in duties regardless of difference in cost of transportation.

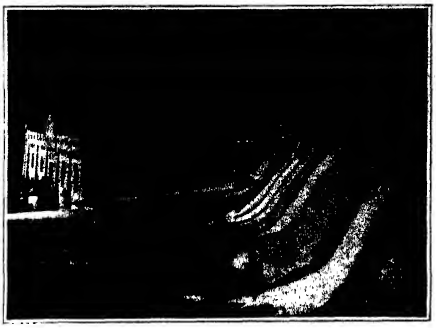
For many years our factories have been protected by a policy of laying such a duty on imported articles that the difference in cost of production at home and abroad is nullified by the tax paid on foreign goods. Under this system our factories have prospered until they are able to do without the tariff. If our merchant marine needs protection, why not protect it in the same way? It is agreed that for various causes, most of them temporary, it costs more to transport goods under the American than under a foreign flag This is the economic cause which has ruined the American merchant marine. To rebuild our merchant marine, we must remove this cause. The best way to do this is to make the difference in duties between goods brought in American and foreign bottoms such that for every commodity and every voyage it will just compensate the difference in cost of transportation. This will enable American vessels to compete with the ships of all other nations in voyages between American and foreign ports. Such a system of preferential duties, regulated by a board similar to the Tariff Board, would place our merchant marine in a position to compete with the world, while yet preserving that healthy competition which is necessary to any enterprise

It has been pointed out that with all our shipyards working to their full capacity, it would take twenty years to construct sufficient vessels to carry our trade Then for a few years some of our ships must be built in foreign yards or transferred from foreign registry Our problem then is to find the most satisfactory method of admitting foreign-built ships to American registry The free-ship plan would admit foreign-built vessels owned by Americans to registry without any stipulation as to condition and with no fees This would force our yards to compete with the oldest and most efficient yards of Europe at a time when they are least able to stand it. Such a method would inevitably lead to the practical annihilation of our shipbuilding industry Manifestly then free ships are impossible Then let us find a method which is satisfactory

It costs less to build a ship abroad than it does at home. This is due to cheaper labor, cheaper materials, and better management. If it costs less to build a ship abroad than it does at home, our shipyards cannot compete on a free and equal basis. Then why not apply those same principles of protection which have been so successful in stimulating our manufacturing industries? Why not lay a tax on the American registration of foreign-built vessels which will just compensate for the difference in cost of production at home and abroad? Under such a system of protection, controlled by the same board which is suggested to regulate our preferential duties, our shipyards would be stimulated by healthful competition without being forced out of business by an economic factor beyond their control This system would automatically cease when the shipyards of America cease to need it—when the cost of production at home and abroad is equalized

With the experience which we have had in protecting our factories, it would seem that the application of the same principles to our maritime problems should at least receive careful consideration. Any action which the Government takes on this most important subject must come as the echo of the thought of the people, and we can have no action until the people have considered the question from all sides.

Bergen, N. Y. W ARNOLD HOSMER.



Lienfoss power station.

Factories at Saaheim.

A Mammoth Norwegian Power Plant

Telemarken's Great Industry

NORWAY has entered the ranks of the countries which are devoted to huge industries. Throughout the country there is evident a feverish ambition and energy toward being up and doing. Great new factories are being built, and Norway's famous old water-falls ("Foss") are being harnessed for commercial use. Largest and most imposing of all, in this connection, are the enterprises which derive their power from the plant at Rjukan,* the immense industrial works which lie between Mosvand and Hitterdalsvand.

In the course of the last year, principally at the initiative of Mr. Eyde, general director, a number of water-power plants have sprung up in Norway. Among these are the plants at Tysse, Bollefoss, Vammafoss, Lienfoss, Svaelgfoss and Rjukanfoss. These plants are to serve electro-technical science and industry, and the harnessing of the waterfalls may be said to mark a turning point in the economic development of the country.

The last three of the above mentioned water-power plants, Svaelgfoss, Lienfoss and Rjukanfoss, are all built exclusively for the manufacturing of saltpeter—Norwegian saltpeter, as it is called, in distinction from Chili saltpeter. Chili, as is well known, has hitherto been the only country from which this absolutely necessary product could be obtained for agricultural fertilizing purposes.

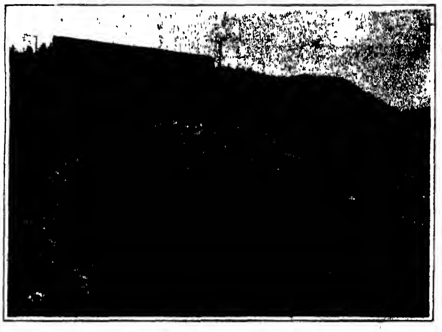
Of the three plants Rjukanfoss is the largest and the most impressive. With its 145,000 horse-power, it is one of the world's great power plants. Not even the plants which are located at Niagara have so powerful and extensive a system. When the other plant, Rjukan No. 2, is completed an additional 125,000 horse-power will be obtained, so that the power utilized here will be 270,000 horse-power, which is more than half of the combined power that once sufficed for all of Norway's industries put together in 1900, viz. 533,758 horse-power.

This is the world-famous Rjukanfoss of Norway, the power of which has thus at last been harnessed. The huge "Kettle" situated under the falls, from which the water rose perpendicularly into the air, and from which the old "foss" sent its powerful bass-voice out over the valley in an everlasting monotonous hum, is now almost entirely dry, and not a sound is to be heard. Where the old mythical Marisit, famous in saga and folklore, almost "hung" down from the side of the mountain, there is now to be found a broad wagon road running into and along it.

In order to supply permanent water-power the year round, the Moswater situated in the mountains has been walled in and dammed up. Not less than 28,250 million cubic feet can here be kept back and collected when the snow thaws in the springtime, and the waters from the mountains rush down toward the valley. In this way the river Maana, which forms the outlet for the waters of Moswater, throughout the entire year can be made to flow along with a velocity equal to 1,660 cubic feet per second, and the power station in this way is enabled to furnish always the same amount of energy to the factory.

Moswater is, without exception, the greatest water reservoir in Europe, and in the entire world it is excelled only by the mighty Assuan dam over the Nile, in Egypt.

About 6.2 miles below Moswater, and 1.9 miles above the old Rjukanfoss, at Skarsfoss, the entrance to the power station Skarsfosdammen is situated. Here commences the 3-mile long tunnel. One huge fall rushes downward, with a number of smaller falls augmenting it in its course, and the tunnel runs along the mountain side slightly leaning inward, until it winds up in an open basin about 3,610 feet wide and 49.2 feet deep, blasted out of the mountain. From this the water is taken and carried through ten conduits about 5 feet in diameter, down to the turbines in the power station called Rjukan Power Plant No. 1—dropping in their course about 950 feet perpendicularly.

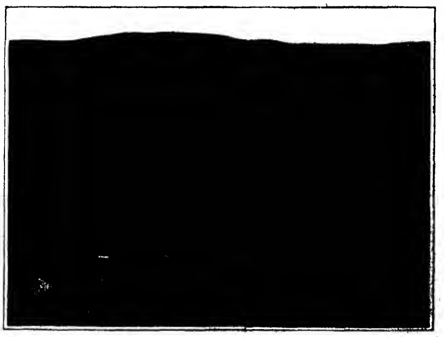


Pipe lines running from reservoir dam 870 feet to power station.

If the machinery in the power station is to be stopped, the penstocks are closed, whereby the water is liberated out over the mountain-side. Nearly 1,640 feet vertically measured, the water falls down before it reaches the river at the bottom of the valley. It is the "new" so-called Rjukanfoss which is thus being artificially created through technical skill and human ingenuity—a fall even more impressive than was the old Rjukanfoss.

From the power station the water is once more led into the tunnel, situated in the mountain-side, and carried about 3 miles downward to the other power plant, Rjukan Power Plant No. 2. However, as long as Rjukan No. 2 is incomplete, the water from Rjukan No. 1 continues to fall 328 feet perpendicularly downward to the river, at the bottom of the valley.

Each of the turbines in the power station represents 14,500 horse-power. This is one of the most gigantic water systems of its kind in the world. The turbines are coupled directly to the generators. It is this machinery which furnishes through conduits to the factory the electrical current which runs them.



Rjukan power station with pipe line.

Between the power station situated at Vemark and the saltpeter factory at Saaheim is about three miles. Above, at the station, not much is to be seen of the five to six thousand people who have moved into the valley; for the service necessary for the plants is comparatively small—only about 40 to 50 men being required.

If, however, we follow the development downward into the narrow valley, we soon encounter at a few miles the new town called Saaheim.

The power conduit in the factory enters it through the "furnace house" so-called. Here the electric furnaces are located, partly erected by Birkeland-Eyde, and partly of German construction. In these furnaces great electric flames burn, and air is forced into them with great velocity.

owing to the electric flame and the high temperature which prevails in the furnace, the elements of which the air is composed are in part forced to combine with one another in a peculiar chemical compound, while the air in its natural state consists only of a mechanical blending of various gases, and where, therefore, each variety of gas exists separately. By the chemical combination of these two elements nitric oxide is produced, which forms the basic principle for the making of nitric acid, and through this, of saltpeter proper. In order to manufacture saltpeter, a big apparatus is, however, required, because the gases which are liberated from the furnace with a temperature of several hundred degrees Centigrade must be cooled and subjected to a prolonged chemical process, before being converted into nitric acid.

The cooling takes place in the following manner: The hot gases are carried through the fireboxes and boilers. The steam which thereby is produced is again utilized as motive power for pumps, locomotives, etc., and for the further manufacturing of the product. The most imposing feature in the entire manufacturing process is, however, the great absorption towers, in which the gases are converted through water into nitric acid. These colossal towers are built of granite, they are ten-cornered, about twenty-three feet across and over sixty-six feet high. Within the tower, which has a floor area of 75,350 square feet and a height of about ninety feet, stand no less than 32 huge granite towers, besides many additional iron towers and machines. The tower proper is so large that the royal palace, which stands in the royal park at Christiania, could be placed within it.

The saltpeter is manufactured by a process through which the nitric acid is led over limestone, which in this way is decomposed. The decomposition is there after saturated with live steam from the above-mentioned coolers, until the complete mass becomes a solid, which thereupon is powdered and packed into barrels ready for shipment.

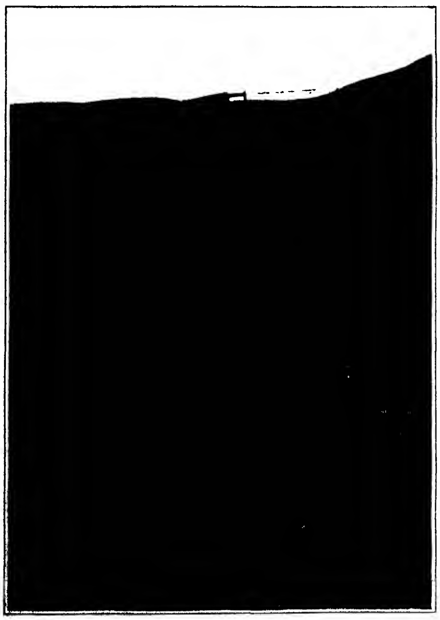
The factory has its own mechanics' workshop, and, of course, a barrel factory, which last named can produce upward of 6,000 barrels in 24 hours.

On the other side of the river lies the town of Saaheim itself. It has about 5,000 inhabitants, and will, presumably, in the course of a few years, when the other great plant, Rjukan No. 2, has been completed, grow to more than twice its present number of inhabitants. The company has invested heavily in the town, modernizing it in every respect, and it makes throughout a solid and comfortable impression. The houses are for one, two, and four families. Of late "Own Home" houses have been also built, for which the company supplies easy loans to its workmen, engineers, etc. Water pipes are installed throughout in the new houses, also laundry and modern water closets. In the same way modern streets and roads have been built with up-to-date sewers, etc. Electric light is, of course, installed everywhere.

On the same side as the factory, just below it, lies Saaheim railroad station. For shipment of goods to and from the factory the company has built its own electric standard gage railroad, all the way from Notodden and up to the ferry connection, Rollo ferry, so called, over the beautiful Tinn Lake, where the railroad cars are transported across directly on the ferry. The railroad is 28.6 miles long, and the ferry connection over Tinn Lake is about 22 miles. The Tinn Lake is regulated by a dam called Tinnosdammen The Tinn River is dammed up through the magnificent Svaelgfoss, making a large sheet of water, which now is called Kloumannsj Lake. Here lies, directly under the dam, deep down at the old river bottom, the large Svaelgfoss power station, which sends its 40,000 horse-power in a colossal power conduit to Notodden. This plant is comparatively the cheapest in the world of its kind. On the road to Notodden 15,600 horse-power is brought from Lienfoss power station into the same conduit and carried by Tinnfoss down to the factories of Notodden, where saltpeter is also manufactured. At Notodden the product is shipped to the company's huge warehouse and shipping point, Menstad, down by Skienselven. When in the course of a few years—as it is reasonable to presume—the present canal at Skien, Notodden, is widened, the sea-going ships will be able to go straight up to Notodden, and it will, without a doubt, not be long before all the other waterfalls in Telemarken are harnessed for industrial use as well.

In Norway are to be found many dormant natural riches, which, however, hitherto have been considered too poor or of too small a yield to be able to take up the competition with those of a similar nature in other countries. Through the development of electro-technical science of later years, the cheap motive power which the waterfalls of Norway have supplied, will undoubtedly enable her in many directions to take up the competition with the old industrial countries. One must, however, not lose sight of the fact, as is often done, that it is not alone the motive power which plays a dominant and deciding part in the industrial development of a country; other factors have to be reckoned with in the final analysis, among which are shipping facilities and cost, freight, labor conditions, taxes to state and community, etc. These very often are just as important as the first. It is, therefore, of vital importance that the country should endeavor to create for its new industries that are trying to get a permanent foothold there, as good and cheap transportation and similar accommodations and attractive labor conditions as possible Regard must also be had for the people who make their energy part of the enterprises, identifying themselves with the works. If this is done, without a doubt, before long the great plants in Vestfjordsdalen will be followed by others of equal magnitude and as important for the country

Thirty-Two Aluminium cables leading to the factories at Saaheim.



Towers for aluminium cables.

Academic Freedom in the Orient

IN wonderful contrast with our most distinguished seats of education, El Azhar, the celebrated university of Cairo the greatest and oldest high school of the Mohammedan world, recently passed the thousandth year of its existence. But unlike our universities, of which the systematic management is always a brilliant phase of their progress, this educational focus of the Orient is also a remarkable example of a really unrestricted, perfect academic freedom. All tribes, peoples and races are represented in the body of students embraced by the university, the number of the last never being the same, but fluctuating between 2,000 and 3,000. This extraordinary alma mater, it must be said, can awaken and retain the affection and loyalty of students with greater ease than any other university, for in very numerous instances the object of the avowed disciples of her particular cycle of sciences who enter the consecrated halls of El Azhar is not merely to attend the lectures, their residence and work between the walls of the university being really a portrayal of their whole lives. Even the barbers have a permanent station in the great vestibule, so that these special students do not need to leave the university in any event.

The heart of the institution is the great court which is splendidly paved Upon it scores of little doors open and loggias and balustrades in great number abound As an architectural entity it is a picturesque oriental masterpiece Those students who with least ease can pay for a small cell in the university incur no expense for the spaces on which they sleep under the roofs of the great open social hall. There is no fee for matriculation, and there is no obligation to pass any examination. Unsubjected to tests and omitting any stated conclusion of study there go forth from El Azhar orators lawyers, physicians and poets, many a man among them having lived for decades within the precincts of this alma mater The teachers and professors receive no salary or other strict compensation, they live on the voluntary dole and presents of their pupils, on the meager price of private instruction, and on the fees they receive for copying old books and manuscripts There is no faculty that calls the professors, no authority that appoints them, every pupil of the university can establish himself after a few years of study independently as a teacher in the halls of El Azhar, begin to lecture and to teach the truth as he knows it or believes he knows it And under such apparent laxity of administration the great university continues an existence that is by no means precarious In the opinion of its staunch friends, of its beneficiaries and of the young men who are waiting to throng to its halls, its authority and importance are more obvious and brilliant and impressive now than ever before

The zeal and loyalty of the students who are leaving it at frequent and irregular intervals are incomparable, and are the source of a later rivalry, in business and profession, of such strangeness, prodigious keenness and persistency as must astound the occidental student who may be quite unfamiliar with oriental customs and who is graduated only in strict accordance with the sheer system that prevails during an arduous curriculum, and is, therefore, much more evenly equipped for frank competition.

Henri Poincaré

The Passing of a Great Mathematician and Philosopher

By J. W. N. Sullivan

THE nineteenth century has been aptly called the age of science. It is not that that century surpassed all others in the magnitude of its discoveries, but that scientific results and scientific methods were then, for the first time, brought home to the minds of the people. The general interest taken in the theory of evolution, consequent on the publication of the "Origin of Species," extended to other branches of science. One great cause which contributed to the general spread of scientific ideas at that time was the part taken by some of the foremost scientific men in presenting their results in a form devoid of technicalities, and in such a way as to be readily understood by the average man. Since that day we have had innumerable popular expositions of every branch of science. Indeed, the writing of popular accounts of scientific discoveries has almost taken rank as a distinct profession. Such writers usually confine their efforts to explaining recent positive discoveries. But of late years something far more interesting than any isolated discovery, however wonderful, has taken place. We are in the midst of a general criticism of scientific procedure, and of the value of scientific results. The scientist has grown uneasy. He is no longer sure of the very foundations on which the whole vast superstructure of modern science is erected. To present these intricate questions, these subtle and far-reaching issues, in a form which renders them readily understood of the average man, requires the hand of a master.

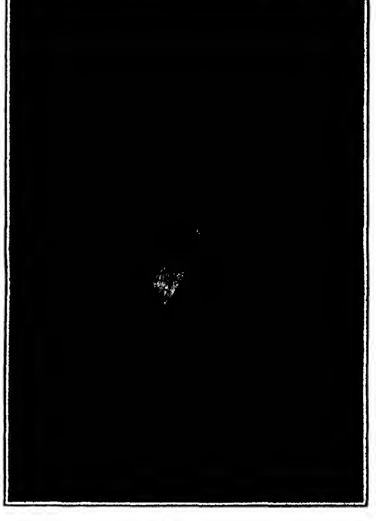
In the domain of mathematics and physics, at any rate, the master appeared. In the late H. Poincaré we had a genius of the first order, a man whose accomplishments in his chosen sphere earned him a foremost place among his contemporaries. By many competent authorities he was considered to have been the greatest mathematician of our day. It would be impossible in the space at our disposal to give an adequate account of Poincaré's work in mathematics, mathematical physics, and dynamical astronomy. We here wish to call attention to his three books, "The Value of Science," "Science and Hypothesis," and "Science and Method."

These works are, in a large measure, critical rather than expository. They contain the profound reflections of their distinguished author on questions of the first importance, and yet are written with such clearness and charm of style that they may be read with pleasure and profit by any ordinary thinking man.

Take, for instance, mathematics, the most impeccable of the sciences. Poincaré sees that its very existence appears paradoxical. We start from definitions and axioms, and deduce consequences which are absolutely necessary results of our premises. We introduce no fresh facts. We make no appeal to experiment. How then can we discover new truths? It would seem that all mathematical reasoning must reduce to a gigantic tautology, and that all the mathematical theorems which fill so many imposing works are simply various ways of saying that A is A.

Poincaré analyzes this paradox and shows that the very essence of mathematical reasoning, and that which alone makes it valuable, is the principle of mathematical induction. This great principle affirms that if a theorem is true of the number 1, and if we can further assert that, being true for the number n, it is true for $n+1$, when we have proved that the theorem is true for all integer numbers. This principle is, in one way, a kind of short cut. It enables us to dispense with the labor of verifying the theorem for every particular case, and is the fundamental characteristic of mathematical reasoning. It alone makes generalization possible.

Again, we all know what great changes have occurred in our way of looking at the fundamental concepts of geometry. Since Lobachevski and Riemann have shown that it is possible to construct perfectly logical and consistent geometries quite unlike Euclid's, the question has arisen in some minds, which geometry is true? For instance, according to Euclid's geometry the three interior angles of a triangle are together equal to two right angles; according to Lobachevski they are less than two right angles, and according to Riemann they are greater than two right angles, and these differences increase with the area of the triangle. Suppose then we effect some astronomical measurements by measuring the angles of the very large triangle formed by the diameter of the earth's orbit and the lines joining its extreme points to a fixed star. If we make our measurements with sufficient accuracy, it would seem that we should be in a position to answer the question, which geometry is true? Poincaré shows us that this is not the case. In making our measurements we have implicitly assumed that light is propagated in straight lines. If we found that the sum of our measured angles was not equal to two right angles, we should not change our geometry, *we should simply conclude that light is not propagated in perfectly straight lines.* We should do this because it would be more *convenient.* This is the key-note to Poincaré's treatment of this subject. It is meaningless to talk about the *truth* of geometric theorems. It is as meaningless as to talk about the *truth* of the metric system. The theorems are necessary consequences of the preliminary hypotheses, and these hypotheses are *arbitrary.* We have selected those we have in preference to others because



HENRI POINCARE

they most nearly and most simply accord with the observed facts *relating to solid bodies* and are, therefore, the most convenient.

We have not space here to give an account of Poincaré's profound remarks on the subjects of space and time, those old bugbears of metaphysics. Suffice it to say that he treats all such questions with unrivaled insight and ability. On the subject-matter of physics proper his views are equally striking and original. He points out that in the accepted theory of matter, the electron theory, Newton's third law, asserting the quality of *action and reaction*, does not hold unless we assume a reaction on the ether which gives the necessary compensation. This fact is of fundamental importance. On analyzing our concept of energy, one of the most important concepts in the whole range of physics, he succeeds in showing that except in a few comparatively simple cases it is very hard to define, and that a general definition simply reduces to saying that in any physical phenomenon there is something which remains constant. This notion of energy, in fact, belongs to a *class of* hypotheses which are distinguished by the fact that they can never be contradicted by experiment. Then there are two classes of hypotheses in science—those which may be submitted to the test of experiment and judged by their behavior under that test, and those which serve us as general controlling principles, but which are outside the range of experiment. Poincaré illustrates this difference very clearly, and an interesting example, taken from biology, has been given by Prof. Royce in his introduction to the American translation of "L'Hypothèse et la Science." This extremely inadequate sketch of the subject matter of Poincaré's popular expositions will, we hope, induce the reader to make the acquaintance of the volumes mentioned. He will find himself amply repaid for his trouble.

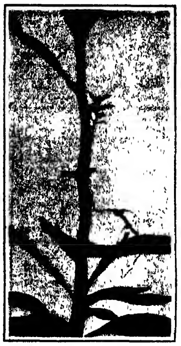
Like many other great men, Poincaré manifested his extraordinary powers at a very early age. He was born in Nancy in 1854, the son of a French physician. As a boy he was rather delicate, and disinclined for the society of other boys of his age. He seems to have been a very engaging child and wonderfully intelligent. He was trained first as an engineer, and received his doctorate in mathematics at the age of twenty-five. But he had very early given proof of his extraordinary mathematical powers. It is related that he never took notes of the lectures which he attended, nor did he ever read the copies of the lectures which were distributed among the students. He simply made a mental note of the results given by the professor, and when called upon, could always supply a proof of his own. Like many other people who are in the habit of indulging in intense mental concentration, he did very peculiar things. He was very fond of walking while engaged in thinking out his problems, and had a habit of "fiddling" with something in his hand. This was so well known at the college where he was a student that the professor gave him a bunch of keys to carry as he paced the corridors in meditation. On one occasion he was discovered on one of the principal streets of Paris carrying a large new wicker-work basket in his hand. He suddenly became alive to the fact, and retracing his steps, found that he had unconsciously purloined the basket from a store he had passed some time previously. It is also related that he was once found packing his trunk with the bed-linen of the house where he was a guest under the impression that he was packing his handkerchiefs. The histories of other great mathematicians, such as Gauss and Lagrange, show that intense mental concentration is often accompanied by this peculiar state of oblivion to the external world. In fact, at times, as in the case of Sir Isaac Newton, it has given rise to temporary suspicions regarding their sanity. Poincaré was a well-known figure in Parisian society, and was by no means the retired mathematical recluse of popular imagination. He was a member of the French Academy of Literature, an extraordinary honor for a scientific man, and a member of a great number of scientific societies in various countries. His published works embrace nearly every branch of pure and applied mathematics. His work in dynamical astronomy is of great value. Among other things, he has made contributions to the famous problem of three bodies which are of the first importance. In general function theory he has created a new type of functions. Together with Klein he has applied some of the concepts of the new geometries to the integration of linear differential equations, and he has greatly helped to develop the branch of mathematics known as Analysis Situs.

It is of the greatest interest to know the way in which the mind of a great man works. On this point Poincaré has given us some most illuminating information. There appear to be three stages in the solution of a problem: first, a period of intense mental effort, usually unsuccessful; secondly, a complete mental rest from that particular problem; and thirdly, a sudden revelation of the solution, followed by a period of conscious effort, trying to find the proofs of the answer revealed. We say *conscious* effort, because Poincaré himself believes that the period of apparent mental rest is in reality a period of intense activity, the activity of the subconscious self.

The first period of intense mental activity seems analogous to setting a number of things in motion, which then proceed to form combinations among themselves. The question why the correct combination, and no other, is presented to the conscious mind, does not permit of any very satisfactory answer. But it is significant that the right combination is the one which most appeals to the aesthetic sense of the mathematician, and there is probably a deep relation between the correctness of a theorem and its mathematical beauty.

A seedling being helped by borrowed roots.

The seedling when first inarched on the nurse plant.



The seedling soon feeds from the nurse plant.

All the vigor of the older plant is sent into the single shoot of the seedling.

Hurrying Nature

A New Method by Which Trees That Fruited in Eight Years are Made to Bear in Two

By William Atherton Du Puy

A METHOD of hurrying trees to their period of fruiting has been discovered at the Government hothouses at Washington. There the men who juggle with living plants and make them do things of which nature never dreamed, have recently succeeded in diverting the vigor of trees that were large and strong, sending their sap coursing through the veins of spindling seedlings and thereby caused those seedlings to do in two years what ordinarily would have taken eight

Take for example the finger lime of Australia This is an exceedingly rare plant. Three years ago it had not a representative in America. About that time somebody sent three seeds of the finger lime to the Department of Agriculture. These were planted immediately and all grew. Being the seedlings were of the lemon family the scientific growers knew that it would require eight years for the finger lime to come into bearing under normal conditions. Eight years is a long time to wait in an experiment.

At just this period the new method of diverting the vigor of other trees into a seedling was in the course of being established. The process is known as "inarching." One of the finger lime seedlings was inarched upon a vigorous two-year-old lemon tree. All the strength of that tree was diverted into the slender shoot. In two years it had ripened its fruit and the scientists were able to judge of its quality. Further, they were supplied with additional seed with which to start new generations of plants.

This shortening of the fruiting time of plants is of inestimable value to the scientific developer of fruits. The breeding of fruits is one of the most fascinating of the modern sciences, and the results that are just now being obtained read like the romances of conjurers. The greatest stumbling block in the way of the working out of these modern miracles has been the length of time required in producing successive generations of a given plant. It has often happened that a scientist has died before he has accomplished the end for which he has set out. But now the time is to be cut to one fourth, and the probabilities are that results will be, in the coming generation, multiplied a hundred fold.

The inarch is accomplished in this way: The seedling is grown to the age of but three or four weeks. It is a weak little plant of but four or six leaves Nature has stipulated that many years must pass before it comes to maturity, blossoms and bears fruit Under the inarch process this stripling is taken up with a ball of earth about its roots sufficient to maintain its life for a few weeks The whole is transferred to a stalwart vigorous tree of a kindred species This tree may be two or three years old. Its roots are deep. It is supplying sustenance for a top that is a hundred times as large as the seedling.

This is known as the nurse tree. The outer bark is scraped from the side of the nurse tree a foot above the ground. The outer bark is likewise scraped from the seedling. The two wounds are bound together with soft cloth bands. The ball of dirt on the root of the seedling is bound to the side of the nurse tree In two or three weeks the plants have grown together The dirt from the roots of the seedling may be removed. It is now drawing its vigor from the nurse tree. Eventually its roots are cut off smoothly below the point of union The nurse tree has taken the little orphan plant unto itself

But this is not the end. After the union is thoroughly established the plant juggler cuts the top off the great vigorous nurse tree. Then is all the nourishment that was going into its top diverted to the single small stem Then do its roots which have been establishing themselves deep in the soil for years send their vigor into the small seedling The result is such growth as nature never knew The twig has such an abundance of nourishment that it vents some of it in fruiting before its time. And this early fruit is strong and vigorous, showing the utmost possibilities of the tree

There are scores of experiments which the Department of Agriculture has had under way for many years, that have been worked through the slow cycle of generations of plants, but may now be hurried by means of the new method There is the citrange, for instance The citrange is a hybrid fruit It was obtained through that scientific development in fruit breeding that has been going on for the last decade and which has as its basis the cross-fertilization of kindred fruits

The orange, the grapefruit, the lemon, the tangerine, even that ornamental plant known as the mock orange or Japanese orange, all belong to the same family Their relation is so close that they may be cross bred Plants may be cross bred by shaking the pollen from the flower of one into that of the other The process in nature is brought about by bees carrying the pollen from one flower to the other So the scientist, wishing to cross certain varieties, prevents the fertilization of the flowers by the bees by putting paper bags over the given blossoms Then when the time is ripe for the experiment, he removes the bags, shakes the pollen from the flowers of the one plant into those of the other and puts back the paper bags The seeds that result from the fruit from these flowers will be a cross between the two plants used in the experiment They may be planted and the hybrid fruit grown. This is just what has been done between the ordinary orange and the mock orange The mock orange is a cold resistant plant. It will grow as far north as New York The great difficulty with the oranges and citrous fruits in general is that they can grow only in communities not visited by frost So the scientists have sought to cross the cold resistant branch of the orange family with the branch that produces the best fruit and thus secure a plant that will produce a good fruit and will also grow in a cold climate.

Now a hybrid seed so obtained requires, under the methods of unaided nature, the accustomed eight years to bear fruit. A wait of that length of time is necessary before the experimenter knows

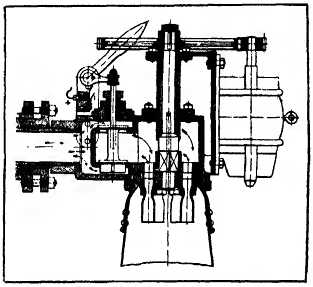
(Concluded on page 86)

A nurse plant with its arms full of seedlings, shortening the fruiting time.

Australian finger lime, the first of its kind ever grown in America, was hurried to fruiting by means of the inarch.

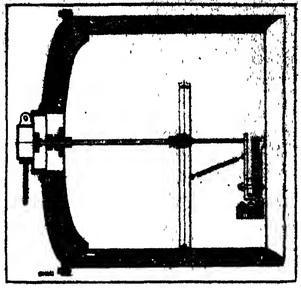
Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks



1.—Vertical section of vibration producer. The disk rotates at a uniform speed so as to give a note of constant pitch. The steam enters the central pivot, passes through the balanced valve and escapes through the expanding nozzles into the small end of the trumpet. The balanced valve is controlled by means of a handle, and the opening and closing of the valve makes and breaks the circuits.

2.—Sir Hiram Maxim, whose latest invention is here described in his own words, believes that it is possible to avoid such disasters as the sinking of the "Titanic" by causing obstructions in the path of a vessel to reflect vibrations produced on the vessel itself. The reflected vibrations are caused to act on sensitive instruments installed on the vessel.



3.—Apparatus for converting the inaudible waves of the echo into audible sounds. Atmospheric vibrations cause a diaphragm to vibrate like a drum-head. In moving it makes and breaks electric circuits and causes bells of various sizes to ring. The pressure of air in front of the diaphragm produces a corresponding pressure inside of the cylinder.

Preventing Collisions at Sea

A Mechanical Application of the Bat's Sixth Sense

By Sir Hiram Maxim

This article is abstracted from a volume published by Cassell & Company, Ltd. For lack of space it has been impossible to present in full the author's ingenious arguments for supposing that a bat really can project vibrations and guide himself by their reflections from surrounding objects under conditions that render the use of the eyes impossible. Moreover, we should like to see the arguments made substantiated by experiments conducted by some competent modern biologist. Sir Hiram's apparatus, however, is based on sound mechanical and physical principles and needs no biological analogue to convince one that it is sound. The reader is referred to Sir Hiram's book for a complete description of the instruments described and of their operation. We can give here only the barest outline.—Editor.

THE wreck of the "Titanic" was a severe and painful shock to us all, many of us lost friends and acquaintances by this dreadful catastrophe. I asked myself: "Has Science reached the end of its tether? Is there no possible means of avoiding such a deplorable loss of life and property? Thousands of ships have been lost by running ashore in a fog, hundreds by collisions with other ships or with icebergs, nearly all resulting in great loss of life and property."

At the end of four hours it occurred to me that ships could be provided with what might be appropriately called a sixth sense, that would detect large objects in their immediate vicinity without the aid of a searchlight.

Much has been said, first and last, by the unscientific of the advantages of a searchlight. Collisions as a rule take place in a fog, and a searchlight is worse than useless even in a light haze, because it illuminates the haze, making all objects beyond absolutely invisible.

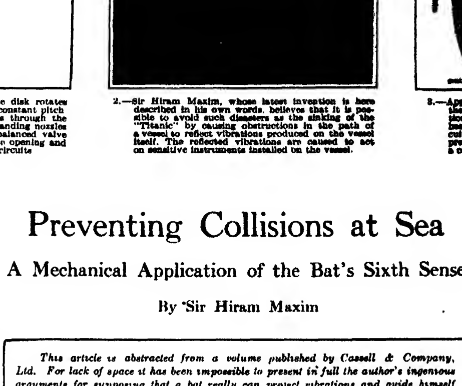
Some have even suggested that a steam whistle or siren might be employed that would periodically give off an extremely powerful sound, that is, a veritable blast, an ear-piercing shriek, and then one is supposed to listen for an echo, it being assumed that if any object should be near, a small portion of the sound would be reflected back to the ship, but this plan when tried proved an absolute failure. The very powerful blast given off by the instrument is extremely painful to the ears and renders them incapable of hearing the very feeble echo which is supposed to occur only a few seconds later. Moreover, sirens or steam whistles of great power are extremely objectionable on board passenger ships, they annoy the passengers and render sleep impossible. It is, therefore, only too evident that nothing in the way of a light or noise producing apparatus could be of any use whatsoever.

Experimenters are fully agreed that the bat possesses what might very properly be called a sixth sense, and that it is able to pursue and capture small insects in the dark under conditions in which eyes would be of little or no use. It is a very curious fact that, notwithstanding that the organ of the sixth sense is the most conspicuous organ possessed by the bat, none of our scientific men have discovered it. It was evidently *too* apparent to be observed, and reminds one of Christian in "Pilgrim's Progress" who was digging in the muck for a crown when the crown in question was directly over his head and very conspicuous. In many cases, the organ that gives the bat the sixth sense is spread all over its face. In the vampire bat the organ is on the tip of the nose; it stands up in the air, and is called the "shield," but in most of the small bats that catch insects on the wing, we find two little leaves, not unlike the wings of the insect that it pursues, standing up just in front of the ears. Others have the sensitive spots located on other parts of the face.

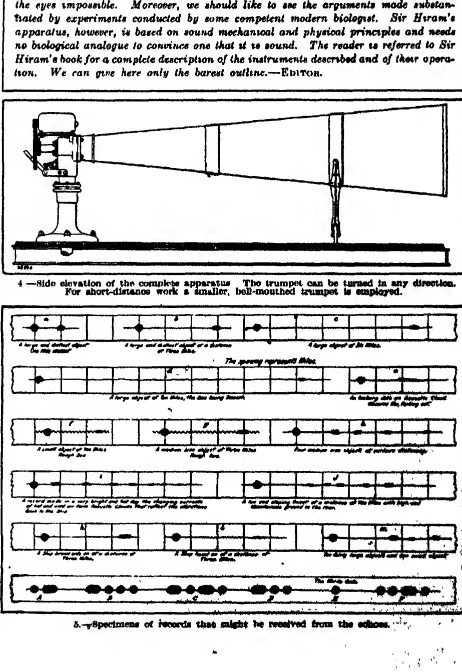
Let us see now what takes place, and what it is that enables the bat to fly about through all manner of obstructions without touching anything, after the manner of a swallow. What enables it to pursue a fly or a beetle in a degree of darkness which renders eyes useless?

In the bats that feed on swiftly flying insects, we find that this small organ is about the shape and size of the wing of the insect on which it feeds. The beat of the insect's wings is communicated to this organ and enables the bat to follow the insect and seize it without seeing it. This is very simple and easily understood, because the insect itself produces certain atmospheric vibrations to which the little leaves in front of the bat's ear respond, but when we come to inanimate things that give off no vibrations of themselves, how does the bat know of their presence? How is it able to judge of their character?

It has already been shown that the wings of the bat are extremely sensitive and very well provided with nerves, and the same is true of the various organs on the face; of course, all of these are intimately connected with one another, and also with the brain of the bat. When a bat flies about in total darkness, the beat of its wings sends out a series of pulsations or waves after the



4.—Side elevation of the complete apparatus. The trumpet can be turned in any direction. For short-distance work a smaller, bell-mouthed trumpet is employed.



5.—Specimens of records that might be received from the echoes.

[illegible] waves, but of too low a [illegible] to be considered as sound. These waves strike against all surrounding [illegible], and, like sound or light, are reflected back to their source of origin. The wings send out the vibrations or impulses and they are reflected back and received by the sensitive organs which form a part of the face of the bat. The extremely delicate nature of the bat's wings, together with the sensitiveness of its organ of the sixth sense, enables it to judge the distance to any object by the lapse of time between the sending out and the receiving of the waves, because it takes some time, some fractional part of a second, for a wave to travel from the bat's wings to the object and return to the bat's face.

We know that this is the mechanism that gives to the bat what is practically a sixth sense. We know it must be true because it cannot be otherwise. That the bat possesses this power is completely beyond dispute, and this is the only way that it can be accomplished. But all bats do not possess this organ; the fruit-eating bats that do not fly about in total darkness have large eyes and never possess this organ, although in some cases we find the rudimentary remains of the organ which they have inherited from their early ancestors, the same as we have inherited the Darwin tip.

The energy employed by the bat is certainly not more than one-thousandth part of a horse-power, but it serves the bat's purpose perfectly well.

Suppose, now, that we construct an apparatus that will produce atmospheric vibrations of about the same frequency as those produced by the bat, but instead of using the infinitesimal amount of energy employed by the bat, we use two or three hundred horse-power—that is, we send out waves that have an amplitude and energy at least three hundred thousand times as great as those sent out by the bat. These vibrations, although of great energy, will not be audible to our ears, but they will shake up and agitate light objects for a considerable distance, and will travel at least twenty miles, so that they could be received and recorded by a suitable apparatus at that distance, and would be able to travel at least five miles and send back to the ship a reflected echo that would be strong enough to be detected.

The quantity of steam required would not be very great, because the valve would not be opened very often, and when open would not remain open more than a second at a time; therefore, the total amount of steam required while signaling was actually going on would certainly not exceed ten horse-power.

The apparatus could also be used for communicating with other ships by giving off long and short blasts representing the dots and dashes of the Morse system.

In providing a ship with a sixth sense, we have to consider three distinct devices. one for producing and sending out the necessary waves, one for receiving the reflected waves and making them audible by ringing bells, and another apparatus for recording the amplitude of the waves.

For producing the vibrations of waves, I prefer to use a modified form of a siren, the disk being rotated at a suitable speed by a motor of some kind, preferably an electric motor. I prefer to use a very high pressure of steam, to have all the parts large and strong, and to produce about fourteen or fifteen vibrations per second These will not come within the range of the human ear, consequently they cannot be considered as sound, and as they are of great amplitude and power they are able to travel over great distances, and when they come in contact with a body, the waves are reflected back to the ship in the same manner that sound would be reflected back, but this echo would not be audible to the human ear. I, therefore, provide an apparatus which might be considered as an artificial ear. It is provided with a large diaphragm tightly drawn over a drum-shaped cylinder, and so arranged that the atmospheric pressure is always the same on both sides, [illegible] of any air blast. It is, [illegible] able to vibrate freely in response to the waves of the echo, and its vibrations are made to open and close certain electrical circuits which ring a series of bells of various sizes. If, for example, the object is very small or at a very great distance from the ship, a very small bell rings, while a large object at a distance of two miles would ring a larger bell, and a very large object a still larger bell. This apparatus gives an audible notice if anything is ahead of the ship.

The other apparatus is similar, but instead of ringing a bell it produces a diagram of the disturbances in the air—that is, when there is no noise except that due to the action of the ship or the sea waves, a wavy line is produced; but whenever the vibrations sent out by the vibrator strike an object and return, the wavy line on the paper becomes very much increased in amplitude so as to be easily observed, and the distance that the object is from the ship can be measured by the length of the paper strip between the giving off of the vibrations and the receiving of the echo; therefore, the distance can be determined with a considerable degree of nicety, and the size of the object may be determined by the amplitude of the waves that return.

Very extensive experiments were conducted about forty years ago by Prof Tyndall at the South Foreland. He found that a deep note emitted by a powerful siren traveled a very long distance, and he was rather surprised at the volume of sound that was reflected back from a ship At that time it was generally supposed that snow, rain, and fog were very unfavorable to the travel of sound, but in his experiments he found that such was not the case. The most unfavorable weather for sound is when the sun is shining brightly and when the air is optically perfectly clear. Under these conditions, we have heated air rising up from the earth, and cooler air descending; this produces a kind of a glimmer in which it is very difficult to sight a gun at long range with any degree of exactness. but my apparatus would not be needed in this kind of weather.

It is well known that the air around a large iceberg is extremely cold—in fact, so cold that certain scientific men have thought that it might be possible to detect the presence of icebergs by the use of a delicate thermometer; but the cold air does not extend far enough around the iceberg to make this practical. Cold air, however, lends itself admirably to the use of my apparatus, because the air itself about the iceberg, being of a different density from the surrounding air, acts as a reflector returning the vibrations to the ship.

In Prof. Tyndall's experiments I find the following:

"In the experiments at the South Foreland, not only was it proved that the acoustic clouds stopped the sound, but that the sounds which had been refused transmission were sent back by reflection."

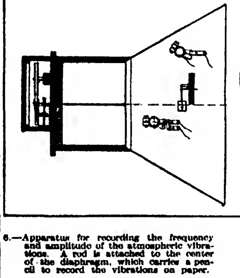
The apparatus for producing the atmospheric vibrations should be placed well forward on the main deck or in any other position where it can be turned about from port to starboard. It should be very firmly secured to the deck, and connected with a high-pressure boiler by a three-inch pipe. A straightway valve should be placed in the pipe near the boiler, and means should be taken to prevent accumulation of water in the pipe leading to the apparatus.

If the sea were perfectly clear, the blasts sent out would be recorded at the very instant of their production, but no echo would be returned other than that due to the waves of the sea, which would produce a zigzag line of small amplitude; but if there should happen to be an object of any considerable size at a distance no greater than two or three miles, the zigzag line on the paper would be changed, the amplitude of the waves would be greater and would be very noticeable. To make sure, the blasts could be repeated several times; and then, if the result should be always the same, it would indicate the presence of some object, and the length of paper between the primary blast and the echo would indicate the distance that the object was from the ship. It might be so arranged that one inch of paper represented a mile.

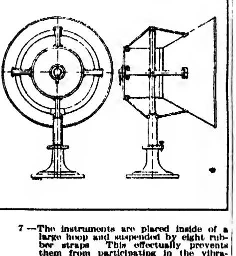
The receiving instruments can be placed anywhere on the ship where they can be turned in the same direction that the siren is turned, and there may be as many of them as desirable.

Of course, there are vastly more accidents caused by running ashore than by collisions at sea, and it does not require a very bold sea front to produce a very strong echo. For example, in approaching the coast of Ireland, the echo would be sufficiently strong to show itself over a distance of at least ten miles

To many it will doubtless appear very difficult, even on the verge of the impossible, to reveal the presence of objects at sea by simply sending out atmospheric vibrations and receiving the echo of the same. One might ask, how can it be possible to judge of the size, distance, and character of the object by the echo? If, however, we make a careful study of the matter, we shall find, if we send out a powerful blast of sound like a deep musical note, that it will travel a long distance, and if it strikes any object of considerable size, it will send back a reflection or echo. Sound is nothing more nor less than atmospheric vibrations. If there are less than sixteen vibrations in a second of time, they are not audible to our ears; we do not hear them, although we may feel them. They may be of great power and able to travel a long distance, and if they should happen to strike any object they send back an echo which, although completely inaudible to our ears, is sufficient to record itself by suitable apparatus, and the record thus made will give us a fair idea of the object struck. It will indicate its size and shape with a fair degree of accuracy; it will indicate its direction from the ship, and will also show its distance with great accuracy. It will distinguish a ship from an iceberg, will show whether the object is stationary or moving, and if moving, the direction and velocity of such movement.



6.—Apparatus for recording the frequency and amplitude of the atmospheric vibrations. A rod is attached to the center of the diaphragm, which carries a pencil to record the vibrations on paper.



7.—The instruments are placed inside of a large hoop and suspended by eight rubber straps This effectually prevents them from participating in the vibrations of a high-powered ship

The Trade-mark as a Business Asset

By W. E. Woodward

[THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer, that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent

The following is the third of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

The Federal Trade-mark Law.—III.

(Continued from page 62, July 20th, 1912.)

The right to register trade-marks is limited to individuals and corporations.

Under the United States law an association cannot possess a trade-mark, as *exclusive ownership* and *specific origin* are essential attributes of validity

The letters "A-A. L.," meaning Anti-Adulteration League, were refused registration as a trade-mark for flour on the ground that the mark did not represent origin, but membership in an association The applicant was a voluntary association of flour manufacturers. It was held that an association cannot be the "owner" of a trade-mark within the meaning of the statute.

Some States have enacted laws prohibiting the unauthorized use of the labels of trade-unions and similar associations The laws are not trade-mark statutes They are based on the broader principle of unfair business competition.

It is the general opinion, we believe, of trade-mark authorities that the lack of provision in our law for association trade-marks is a defect that should be remedied as soon as possible. It is a noteworthy fact that most of the other great nations recognize association marks.

An interesting example of an association trade-mark is that of the Irish Industrial Development Association. This association has a membership of about five hundred Irish manufacturers. Its use indicates that the merchandise to which it is affixed is of Irish manufacture, in other words, it is indicative of geographical origin. The Irish trade-mark has been registered in Great Britain under the British Trade-mark Act of 1905.

An American of the name of D. B. Barrett attempted to register this mark in the United States Patent Office under his own name. This fact came to the attention of the Irish Industrial Development Association and some correspondence relating to the matter passed between Mr. John Redmond, the leader of the Irish National party in Parliament, and President Taft. As the law now stands, this Irish trade-mark cannot obtain in the United States the protection that registration might give.

Within the last few years several American communities have adopted trade-marks, or labels.

There is a genuine need for an amendment to the law that would give this class of marks the right of registration.

A provision of the Act of 1905 legalized all trade-marks that had been in exclusive use by the applicant for ten years prior to the passage of the act, and this provision applies even to trade-marks of ten years' standing that, because of their character, could not be registered under

the act. The wording of the act dealing with this subject is as follows:

"Nothing herein shall prevent the registration of any mark used by the applicant or his predecessors, or by those from whom title to the trade-mark is derived, in commerce with foreign nations or among the several States, or with the Indian tribes, which was in actual and exclusive use as a trade-mark of the applicant or his predecessors from whom he derived title for ten years next preceding the passage of this act."

A manufacturer cannot register a trade-mark and file it away with the intention of using it at some future time. A condition of validity is that the mark must not only belong to the applicant, but must be "used by him in lawful trade." An intention to use a mark is not sufficient. The use in trade must antedate the application for registration. The letter of the law is complied with if a single package of the goods with the trade-mark affixed is exposed for sale.

Those who intend to adopt trade-marks should keep in mind that the use of a trade-mark is limited strictly to one class of merchandise, which must be the class for which it has been registered.

An applicant for registration must specify not only the general class of merchandise in connection with which he intends to use his trade-mark, but must state also specifically the articles in that class upon which he has used the trade-mark he seeks to register.

For instance, a manufacturer who might apply for the registration of "Pendennis," as a trade-mark for smoking tobacco—to select a word at random—would find that it would not be satisfactory to the Patent Office to state in his application that the mark was being used in connection with Class 17—"Tobacco Products." He would be required to state that his mark was being used on "smoking tobacco." After registration had been granted the Patent Office would not register another "Pendennis" trade-mark in that class of merchandise to be used on cigars, for instance, for another applicant. Nor would the first registrant be obliged to apply for a new registration if he should desire to extend the use of his trade-mark to cigars, or chewing tobacco, or any other tobacco product. The law would protect him in the use of the mark for all articles of that class, but the rules of the Patent Office require applicants to give full particulars not only as to class of merchandise but the specific articles on which the mark has been used.

A result of the principle of trade-mark practice which limits the use of a mark to one class of merchandise is to be seen in the same name being used as registered mark for unrelated articles.

The name "Pompeian," for instance, is used as a trade-mark for a face cream and also for wire netting for window screens; "Republic" is used for automobile tires as well as several other articles in different classes, "Packard" for pianos and automobiles, and there is an "Ideal" hair-brush and an "Ideal" fountain pen.

The law directs that the owner of a registered trade-mark affix, print or impress upon such trade-mark wherever it is used, or in close enough proximity to it to be easily seen, the words: "Registered in U. S. Patent Office," or the shorter abbreviated form, viz., "Reg. U. S. Patent Off." The trade-mark of Baker's cocoa—the Baker chocolate girl—shows how this should be done.

If this notification is not used in connection with the trade-mark, the owner of the mark, in infringement proceedings against an unauthorized user, cannot collect damages unless he can prove that he gave the other party formal notice, and that the unauthorized use of the mark was continued after the notice.

A trade-mark is not merely an advertising symbol. It is an essential of trade-mark validity that the mark be affixed to the goods. A device, or word, or phrase, or picture that is used only in circulars, advertisements, or on signs or letter-heads is not a trade-mark and cannot be protected under the trade-mark laws. (It should be stated here that the unauthorized use by another than the owner of such a device or wording may sometimes be prosecuted under the common law—the law of unfair business competition.)

A trade-mark may be printed, pasted, written, stamped, stenciled, branded, sewed or woven upon the article with which it is used. In cases where it is not practicable to affix the mark upon the merchandise itself it must be affixed to the container.

RULES OF THE PATENT OFFICE.

We have not the space here to go into a detailed description of the procedure of the Patent Office in considering trade-mark applications. This procedure, especially in cases where there is some doubt as to the validity of the mark, is highly complicated, and can be followed successfully only by an attorney experienced in trade-mark practice.

The rules of the Patent Office require applications for registration of trade-marks to be made in a certain conventional form. A drawing of the mark, of a certain specified size, must be submitted with the application. Proofs of the mark, as actually used, must also be forwarded as exhibits in the case.

If, on preliminary examination, the mark appears to be entitled to registration, a reproduction of it is printed at least once in the *Official Gazette* of the Patent Office. This publication must be at least thirty days prior to the date of registration.

The purpose of the publication of the mark in the *Official Gazette* is to allow opposition from any one who thinks its registration would conflict with his rights. Opposing an application is technically called an "opposition." An opposition serves to delay registration until the examiner in charge of interference considers the evidence submitted.

Under certain conditions, rejected applications may, on appeal, be taken up to the Commissioner of Patents.

The number of rejected applications is very large. Under the law of 1905 the total number of applications up to May, 1912, was 62,500.

The total number of registrations under the law is around 42,000. This means that more than 20,000 applications have been rejected in seven years. In other words, about two out of every three applications pass the gauntlet of Patent Office scrutiny, interference and opposition, and are registered.

Many of the defective applications fail because of a lack of competent advice in devising the proposed trade-marks, as well as because of inexperience in prosecuting the applications.

(To be continued.)

Notes for Inventors

Wanted: A Collar Fastening Improvement.—Have you ever tugged at the tab of one of the modern high turn-down collars and fretted yourself into a perspiration before finally getting it fastened? If so, you will realize there is a field for an improvement either in the collar itself to make the fastening easier, or in the collar button, or a substitute for such button which will enable the convenient fastening of the collar and securely hold it when once fastened. Attempts have been made by at least one collar-maker to obviate the necessity of buttoning a collar.

A Device That Loads and Unloads Motor Trucks.—There is considerable activity at the present time in devices for loading and unloading motor trucks through the aid of removable bodies which may be loaded and then applied to the truck. Ralph L. Morgan of Worcester, Mass., has secured a patent, No. 1,030,320, for a motor truck apparatus in which the bed of the truck inclines or curves downwardly at one end so it may readily adjust under a body suitably supported at the desired elevation and a platform is provided having a slip for supporting the crate or body, the slip being so formed that the truck may be run into it and the bed of the truck being slightly higher than the top of the slip so that the truck with the crate upon it may be run into the slip and the crate will be supported on the truck over the slip. Then when the crate or body is fastened at its rear end by a chain or the like, the truck may run out below the crate and the latter be left upon the slip.

Women Inventors.—Voltaire wrote that there are learned women just as there are women warriors; but they are seldom or never inventors. It is not clear whether he intended to exclude from the class of inventors, women generally or only "very learned" women. Certainly women have invented in many fields and it is not seen how learning can decrease their ability in such direction, for another writer tells us that invention is activity of mind and is a sharpening of the spiritual sight, to discern hidden aptitudes. Certainly this spiritual sight should not be dimmed by learning.

Legal Notes

A Trade-mark Ruling.—In the case of Burton Medicine Company v. United Drug Company, Assistant Commissioner Tennant has held that where an opposition to the registration of a trademark is filed by a registrant, a cross bill asking for the cancellation of the opposer's registration will not be admitted.

The Case of a Foreign Trade-mark Applicant.—In the trade-mark case of Ross & Brothers v. The Louis Bergdoll Company v. The Greenway Brewing Company, Assistant-Commissioner Billings has held:

"Where a foreigner applies for registration for a trade-mark subsequent to the registration by a citizen of this country of the same mark, that in order to be entitled to an interference with such registration the foreign applicant must make a *prima facie* showing of use in this country."

A Welsbach Incandescent Filament Decision.—The Court of Appeals of the District of Columbia has affirmed the decision of the Commissioner of Patents holding certain claims in a Welsbach application unpatentable in view of the prior art. The filament presented in the application comprised a stable electrically conducting mixture of osmium and one of the described oxides, and the Court, in affirming the decision of the Commissioner, said that other references to prior patents were given, but it thought that the Edison patent furnished a complete anticipation of the claims involved.

The Supreme Court and Improvements.—History shows that the Supreme Court has followed invention and improvements even in its decisions of constitutional questions. While telegraphy was unknown at the time the Constitution was written and the word itself was not in existence, the Supreme Court brought the term word within the meaning or within the scope of "commerce" as used in the Constitution and Chief Justice Waite thus explained the extension of the power:

"The powers thus granted are not confined to the instrumentalities of commerce . . . known or in use when the Constitution was adopted, but they keep pace with the progress of the country, and adapt themselves to the new developments of time and circumstances. They extend from the horse with its rider to the stage coach, from the sailing vessel to the steamboat, from the coach and the steamboat to the railroad, and from the railroad to the telegraph, as these agencies are successively brought into use to meet the demands of increasing population and wealth."

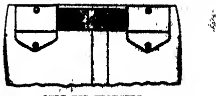
Delay of Application After Reduction to Practice.—In Walker v. Lederer, Mr. Commissioner Moore has decided that "Where W. reduced the invention to practice prior to the earliest date of invention claimed by L., that W. did not forfeit his right to a patent in favor of L. by delay in filing his application where there was no suppression or concealment of the invention." In the course of his decision, the Commissioner says that no case has been cited and he knew of none where a patent had been refused or held invalid solely on the ground of delay in filing the application for patent after a reduction to practice by the inventor and he distinguished from cases where abandonment either intentional or constructive had been established.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the Scientific American.

Pertaining to Apparel.

BELT.—T. Herskowitz, 944 Union Ave., Bronx, N. Y., N. Y. This invention provides a resilient belt for trousers mounted upon the waist-band thereof to maintain an approximately constant pressure on the person of the wearer while expanding to accommodate the movement of the person; provides resilient



BELT FOR TROUSERS.

means for the belt to increase the period of its service; and provides guide members for the belt, said members being attached to the trousers. The advantage in the use of the belt is that the waistband of the garment is held in its correct position upon the wearer's body under all normal conditions. The engraving shows a front view of a fragment of trousers provided with a belt and pocket structure.

Pertaining to Aviation.

AERIAL PROPELLER.—H. L. Elliott, 222 P. O. Building, Kansas City, Mo. The invention is an improvement in so-called screw propellers whose blades are rotatable on their axes in order that they may be set at different transverse angles relative to the plane of rotation of the propeller as a whole, whereby the pitch or lead of the blades may be varied to effect propulsion at different angles.

STABILITY DEVICE.—F. Nyilas, 130 W. 52d St., Manhattan, N. Y., N. Y. This device is more particularly adapted to be applied to aeroplanes. The invention lowers the center of gravity below the center of buoyancy of the floating body. It maintains center of gravity in stationary position with reference to center of buoyancy, irrespective of any force which might tend to change this relation. It will lower the center of gravity during flight and means provide that the device may be moved up parallel with the aeroplane during landing, to economize storage space.

Of General Interest.

PROPELLER.—A. Cardona de los Rios, care of La Alemana Lamparena Electrica, Monte 211 Havana, Cuba. This invention relates more particularly to a propeller comprising an elongated, tapered hub, and an elongated, tapered screw blade, of varying radius, for purposes of propulsion in connection with marine vessels, aeroplanes, etc., which provides means by which negative slip may be minimised.

CIGAR BOX.—J. J. Planco, care of Ruy Suare & Co., 422 E. 53d St., Manhattan, N. Y. This invention relates to a cigar box, and the object is to provide a cigar box in which cigars of peculiar configuration may be packed in position separate from one another so as to prevent injury to the same. Means provide that the cigars are so arranged that they may be readily withdrawn.

Hardware and Tools.

MAGAZINE HAMMER.—O. J. A. Smith, Piedmont, Mo. The purpose of this invention is to provide an improved hammer which is simple and durable in construction, easily manipulated with one hand and arranged for quickly discharging nails, tacks or like fast-

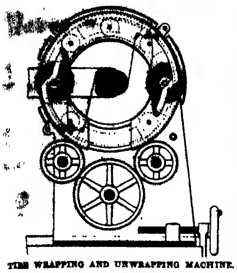
MAGAZINE HAMMER.

eners one by one, for setting the discharged fastener at the desired place on the object into which the fastener is to be driven, and allowing driving the fastener home without requiring the operator to touch or handle the fastener, and leaving one hand free for manipulating the object. The engraving shows a sectional side elevation of the hammer. The inventor's address is care of C. W. Chandler, Greenville, Mo.

ROUTER PLANE.—B. Arlos, 1212 E. 108th St., Cleveland, Ohio. This invention provides a router plane stock with supplemental cutters and routers, the same being placed opposite one another in vertical position and adapted for lateral adjustment as required to cut grooves of different widths. These attachments are located in front of the ordinary router bit, which may be then used to cut and clean out the wood between smaller grooves made by the two attachments when adjusted greater or less distance apart.

[illegible]—J. L. Ashworth, [illegible] Tenn. An object here is [illegible] a device which may be used as a [illegible] a woven wire or a bare-wire stretch[illegible] and which while effectually accomplishing the purpose for which it is intended is simple, and is, therefore, not liable to get out of order.

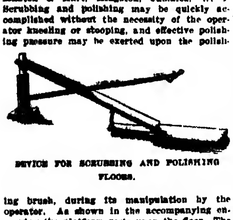
TIRE WRAPPING AND UNWRAPPING MACHINE.—J. W. Throff, care of W. R. Thropp, 2 Stake St., Trenton, N. J. The driving mechanism operates to rotate the tire about its axis at even rate of speed, to secure even winding; a pressure for tire and containing molds is arranged to be imposed on the tire and molds by the driving mechanism, to avoid any friction due to tire movement; driv-



TIRE WRAPPING AND UNWRAPPING MACHINE.

ing mechanism for the shuttle provides for avoiding the need of a filler for gap in the shuttle; a shuttle carries a plurality of bobbins and takes wrapper supply therefor; means provide for removing or renewing the bobbins and supply for the shuttle; also for controlling the speed of the machine, to increase, diminish or reverse the operation thereof, and means to unwind wrappers from the tire and reverse direction of the wrapping. The engraving shows a vertical section of the invention.

APPARATUS FOR SCRUBBING AND POLISHING FLOORS.—F. A. McKay, care of Manton & Hart, Kingston, Jamaica, W. I. Scrubbing and polishing may be quickly accomplished without the necessity of the operator kneeling or stooping, and effective polishing pressure may be exerted upon the polish-



DEVICE FOR SCRUBBING AND POLISHING FLOORS.

ing brush, during its manipulation by the operator. As shown in the accompanying engraving the platform rests upon the floor. The rib being in direct contact with the floor, the operator places his right foot thereon, grasps the handle bar and moves the operating lever back and forth, as shown in dotted lines, thus imparting reciprocating movement to the brush. The device may be moved from right to left as desired to change the point of operation of the brush.

Prime Movers and Their Accessories.

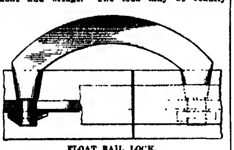
ATTACHMENT FOR OIL WELL APPARATUS.—J. W. Leonard and H. E. Brown, care of G. L. Roberts, 215 Water St., Pittsburgh, Pa. This invention relates to clutches to be applied to machinery adapted to be driven by internal combustion engines. The apparatus may be quickly adjusted to the shaft of a steam engine, the cylinder of which has been replaced by one of the internal combustion type, with the bearing of the extended shaft on which the clutch is mounted, held in rigid relationship to the engine cylinder on a pivoted support to prevent fracture of shaft by the working of the engine on its bed, relatively to the bearing.

Railways and Their Accessories.

TRAIN STOPPING MECHANISM FOR BLOCK SIGNALING SYSTEMS.—M. Conrad, 114 E. Maumee St., Adrian, Mich. This device is for use on trains whose movements are controlled by electric block signaling systems. An object of the invention is to provide means by which the on-coming train may be automatically stopped if the block is not clear.

BLOCK SIGNALING SYSTEM AND SAFETY APPARATUS.—M. Conrad, 114 E. Maumee St., Adrian, Mich. This invention relates to block signaling systems adapted for use on steam or electric roads and designed to be entirely automatic in operation for preventing [illegible] or rear-end collisions on single [illegible] or accidents at crossings and switches, [illegible] dispensing with the usual telegraph [illegible] block offices with their operators and [illegible] and dispensing also with the [illegible].

FLOAT RAIL LOCK.—G. W. Clemmons, 82 Bloomfield St., Hoboken, N. J. This invention relates to a means for locking a car float to a floating bridge. It provides a lock which will maintain the tracks on the float and the tracks on the bridge in alignment, but will, at the same time, permit a slight play between float and bridge. The lock may be readily



FLOAT RAIL LOCK.

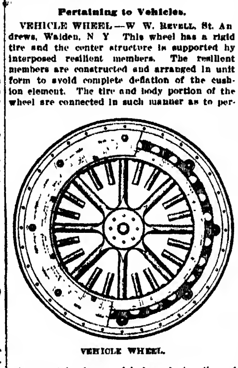
affixed to the rails on bridge or wharf and quickly attached to the rails on a car float. These objects are attained by pivoting a yoke to a rail or bridge or wharf, which yoke has its free opposite end adapted to engage an elongated slot in a correspondingly aligned rail on the float. The engraving shows a plan view looking down upon adjacent meeting ends of contacting rails.

Pertaining to Recreation.

WATER CAROUSEL.—A. C. Bail, 436 E 188th St., Bronx, N. Y. More particularly this invention involves an amusement device made up of a suitable basin in which a number of receptacles, such as tubs, are suitably positioned, means being provided whereby these receptacles may be moved around the basin, a turning movement being imparted to them at the same time.

Pertaining to Vehicles.

VEHICLE WHEEL.—W. W. Revell, St. Andrews, Walden, N. Y. This wheel has a rigid tire and the center structure is supported by interposed resilient members. The resilient members are constructed and arranged in unit form to avoid complete deflation of the cushion element. The tire and body portion of the wheel are connected in such manner as to per-



VEHICLE WHEEL.

mit a certain degree of independent action of the tire and body portion, and to correctly limit the same. The tire construction prevents skidding. The invention provides a tire constructed from relatively thin strips of non-resilient material having disposed therein rings constructed of suitable wire fabric. A side view of the wheel is illustrated herewith.

WHEEL CONSTRUCTION.—H. W. Sanford, care of Sanford Iron Works, Knoxville, Tenn. The object here is the provision of means for preventing wear on the hub and bearing sleeve of wheel mountings, wherein the wheel is journaled on the axle. All end thrust of the wheel pushing inwardly is received by the interchangeable blocks or washers at the center of the axle, thus reducing wear and friction to a minimum.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12662) G. L. M. asks. A friend of mine claims that the recoil of a gun does not commence until after the projectile has left the muzzle of the gun, admitting that if the gun were to be infinitely long, there would be no recoil. Is this true? A. The recoil of a gun begins when the bullet begins to move in the gun. Newton's "Third Law of Motion" is applicable to this case: "To every action there is an equal and opposite reaction." There can be no motion of the gun backward till the bullet begins to move in the opposite direction. There is another way to look at it. If the charge of powder were exploded in a chamber strong enough to hold the pressure of the gases, there would be no motion produced by the powder, and no motion of the chamber in any direction. The recoil is due to the fact that the gun has the same quantity of motion backward that the bullet has forward. If the bullet had the same weight as the gun, the gun would move backward with the same velocity as the bullet moves forward, and would strike the same blow as the bullet. It is the motion of the bullet which produces the recoil of the gun. The force of the powder acts in the same manner in every direction. The sides of the gun barrel resist this pressure and prevent motion sidewise. The bullet, if it does not stick, moves. The pressure of the gases is the same forward and backward, and this force is applied to the bullet forward and to the gun backward. Each has the same quantity of motion, or momentum as it is termed.

(12663) J. H. I. writes: I have heard that copper or zinc filings thrown in a fire will reduce the soot in stove and chimney to a fine white powder, obviating necessity of cleaning. A preparation to accomplish this result was once on the market. I shall be glad if you can inform me if you know of the preparation. A. Two receipts for chimney cleaners are given in "Scientific American Cyclopedia of Formulas." First, make a hot fire, then put the compound in the blaze and put up a blower or close the stove door, so that the gases evolved will rush up the chimney. No. 1. Parts by weight: Copper sulphate 7, coarse salt 6, ammonium chloride 8, saltpeter 5, fine sand 2, coke dust 2. Mix well. No. 2. Chloride of sodium 7, potassium nitrate 4, cuprous sulphate 7, muriate of ammonia 8, flour of sulphur, small quantity. The "Scientific American Cyclopedia of Formulas" contains thousands of useful formulas and processes, and will be found very valuable. It is sent, carriage paid, for $5.

(12664) I. N. V. asks: What is a jet propeller and what experiments have there been made in that line? A. Jet propulsion is a method of propelling a boat by pumping in a stream of water at the bow and driving it out at the stern below the water line. The reaction of the water outside against the jet causes the boat to move forward. Many efforts have been made to produce a successful result but all have been failures, returning but a small per cent of the power expended. We have published the accounts of these experiments as they have been made in the past, and can send you eleven papers upon the subject for ten cents each. You will also find valuable material in Kent's "Engineers' Pocket Book," which we will send for $5.

(12665) J. F. McG. writes: In the issue of June 1st of the Scientific American appears a question by W. O. E. (No. 12643) about the duration of life of toads and frogs in rock. By your reply, it would seem you place no credence in the idea of these creatures having a long life, almost indefinite, under certain conditions. Permit me to supplement W. O. E.'s question by relating what I was an eye witness to, viz., a toad being taken out of rock and still alive. This district is a limestone region, the layers of rock running from an inch to eight inches in thickness, and along the river valley this rock is right at the surface, blasting being necessary from the start in any excavation work. Now a well was blasted out in this vicinity, and during the process, when at a depth of fourteen or fifteen feet, a small cavity was disclosed in which was a fair-sized toad. Mr. Toad was put on top of the bucket and hoisted to the surface, and to all appearances was dead. He was tossed out into the sun, but strange to say, his dormant condition began to disappear, and it was not many minutes before Mr. Toad was hopping around like any other one of his kind, the only difference being he did not exhibit ordinary toad intelligence, as evidenced by his lack of judgment when he hopped plumb into a batch of fresh slaking lime. He was fished out with a hoe, but whether he survived this treatment or not, I do not pretend to know; but the fact remains he came out of a rock hole at a fair depth, and the question is, how did he get into such a place, and how long had life been existing in him?

NEW BOOKS, ETC.

Forney's Catechism of the Locomotive. Third Edition. Revised and enlarged by George L. Fowler, Associate Editor *Railway Age Gazette*. New York: The Simmons-Boardman Publishing Company, 1912. Distributed by the McGraw-Hill Book Company, 239 West 39th Street, New York. 2 vols. 6 in. by 9 in. Price, $5, sold separately per vol. $3.

Books, like individuals, have their histories, and Forney's "Catechism of the Locomotive" practically originated in a translation of Kosak's "Katechismus der Einrichtung und des Betriebes der Locomotiv," which the editors of the *Railroad Gazette* had made intending to re-publish it in their journal. This translation was submitted to Mr. Forney for revision and adaptation, but he found that the scope of Kosak's work was too limited for American practice and requirements so that while retaining the "idea" of a Catechism and following the general plan of Kosak's work, he so far extended and enlarged upon it as to make it substantially a new and original book. The late Mr. M. N. Forney was one of the highest authorities in locomotive engineering, and those of us who had the privilege of knowing him will remember not only the remarkable depth of his information, but his rare ability to clothe his ideas in concise, clear and simple language, making his meaning "plain to plain people." These endowments enabled him to write a book, the object of which was "to furnish a clear and easily understood description of the principles, construction and operation of the locomotive engine of the present day, a subject which is not concisely or adequately treated in any one similar book." This work was published in 1873, and it was the best known and most widely studied book on the subject in this or any other country. It was afterward revised by Mr. Forney and a second edition was published in 1889. Since then the locomotive has undergone great changes, not only in size but in construction and operation, and a third edition of the book became necessary. This work was intrusted to Mr. George L. Fowler, an eminent engineering authority, who was a friend of Mr. Forney, and who had been asked by the latter to undertake the revision, with the result that we have in the present edition by far the most complete presentation of the subject that has appeared and one which will not only be indispensable to all who are engaged in the management, construction and working of locomotive engines, but a most useful book to a large class of readers and students in this country and in Great Britain who, while they are not connected with railways, have a deep admiration for the locomotive—the most interesting form of the steam engine. In preparing the new edition, it was found that the great increase in size and complexity of the locomotive engine necessitated the introduction of much new matter, such as the system of compounding, the introduction of the Mallet engine, the superheater, the Walschaerts valve gear, the mechanical stoker, and recent extensive improvements in the air brake system, as well as other details. It was, therefore, decided to break the book into two volumes, making each complete in itself. The first volume deals with the practical construction and operation of the locomotive in a way to make it intelligible to men who have not had the advantage of a technical training. There are 743 questions with their answers, 644 pages and 475 illustrations, to which are added six folding plates of locomotives, valve gears and air brakes. The colored diagrams showing the construction and operation of the Westinghouse air brake and of the Stephenson and Walschaerts valve gears are admirably full and clear. The second volume discusses the same points more theoretically, but always in simple language devoid as far as possible of mathematical calculations, and shows why locomotives are built as they are and the principles of their operation. This volume comprises 375 questions, with their answers, 293 pages and 190 illustrations. The letterpress and engravings are all excellent, and last but not least, each volume has a full and carefully prepared index by which the reader can readily refer to any particular topic in the book.

Unity in Nature. An Analogy Between Music and Life. By C. E. Stromeyer, M.I.C.E. London and Manchester: Sherratt & Hughes, 1911.

It would be difficult to find a book at once so metaphysical and yet so practical. An engineer by training and experience, it is to be expected that Mr. Stromeyer is not in sympathy with some of our modern scientific ideas. He does not like our current conceptions of the ether, for example, and substitutes a theory according to which space is filled with a thin gas. So, too, we find him dissatisfied with current conceptions of energy. He still adheres to the old definition of energy as a product of force into distance. Nowadays the principle of action and reaction is more strictly adhered to. Most excellent reading is to be found in the essay on "Science and Soul of Music." This is indeed a splendid piece of illuminating writing. Perhaps the most amazing characteristic of the book is its diversity of subject matter. It would hardly be expected even in a book on the unity in nature to find essays on "Flatland," "The Essence of Music and Life," "The Fourth Dimension," "Geological Records," "State Incongruities," "Urbanism," and "Ruralism." Yet the author has woven them together in a most ingenious fashion.

The Why and Wherefore of the Muffler and Cut-out

By Harold Whiting Slauson

ENGINEERS have been laboring for years to produce the silent car. Months of constant experiment have been spent in efforts to evolve a quiet transmission or forward train of gears, and only by the use of special bearings and accuracy and detail to the thousandth part of an inch have the results as exemplified in the modern automobile been obtained.

But of course the noisiest part of a car is the motor, and anyone who has attended a road or a track race will bear witness to the fact that the power plant announces its importance in no uncertain terms when its exhaust is unrestrained by a muffler. And for good reason does an unmuffled and healthy motor make itself heard, for it is a tremendous power that is harnessed in the cylinders and made to expend its energy in forcing down the pistons. Each explosion in each cylinder generates a pressure approximating 250 pounds on each square inch of piston surface. This means that, in a 50 horse-power, four-cylinder motor, a force of nearly three tons is concentrated on each piston with every ignition of the charge in that particular cylinder. Or, if we consider the gas engine as a whole, a total of over 5,000 tons is exerted on the pistons each minute that the motor runs at normal speed.

These are imposing figures, and it may be wondered why such a gasoline motor develops *only* 50 horse-power, but it must be remembered that this force is not applied continuously but that it is divided into a number of three-ton "hammer blows" of short duration. After the first "impact" the pressure decreases until, at the end of the stroke, it is scarcely sufficient to overcome the friction of the motor. But though the three-ton energy of each explosion is soon expended, there is still a considerable force, amounting to three or four times the pressure of the atmosphere, that must be disposed of at the bottom of the stroke. This is the exhaust, and when this pressure is suddenly turned loose into the open air by the quick motion of a valve, a sharp report is bound to occur, for the force in question is really the "tail end" of the explosion that has but just taken place in the cylinder. Let two thousand of these "tail ends"—each of which is pretty vigorous by itself—occur in a minute, and it will be realized why "ear-splitting" is a mild term to apply to the unmuffled exhaust.

Now to many of us, the term "muffle" may convey the idea of to choke, or cover up, and this, in a sense, is what the muffler does to the noise of the explosion. But the muffler does not throttle the exhaust with a high hand and say, "You shall not escape," but rather does it lead the gas to expend its energy by easy stages. It does this by providing a chamber in which the exhaust gas may be expanded before reaching the outside air. If the exhaust were carried through a series of expansion chambers, it would have become quite meek and subdued by the time it was discharged, for as it expands, so its energy—and consequent noise-making ability—is expended. But in order to save space and weight, many mufflers are in the form of a single expansion chamber provided with a series of "baffle plates," or disks, containing a number of perforations through which the gas passes, and thus the exhaust expends most of its energy in these and is rendered practically harmless by the time it has reached the place where it could make any impression on the human ear.

Many motorists consider the word "muffler" to be synonymous with "back-pressure," and as they know that this latter term means a resistance to the passage of the exhaust gases and a consequent reduction in the power developed by the motor, some of them have come to look upon the muffler as a power-absorbing device. In consequence of this belief, the cut-out, by which the exhaust gases are allowed to escape directly into the open air without first passing through the muffler, has become one of the most used—and abused—accessories of the car. Its *abuse* has become so flagrant, in fact, that many cities and towns have enacted ordinances prohibiting its use, and it is looked upon as the one device that is setting at naught the efforts of the designers and builders toward the production of the silent car.

It may be that the old type of muffler, provided with many obstructions to the passage of the exhaust gases, produced an appreciable amount of back-pressure that absorbed some of the power developed by the motor. The power plant of the modern car, however, is equipped with a muffler of a type that, by means of especially-shaped passages and expansion chambers, enables the speed of the out-rushing gas to be increased so that the resistance of the muffler may be nearly overcome and the amount of back pressure will be reduced to very small figures. In fact, tests that have recently been made on several motors when run both with and without the muffler in place have shown some surprising results. These tests demonstrated that, for all practical purposes, the muffler produced no diminution in the power developed by the motor at slow and medium speeds. On the contrary, some of the tests showed that the motor produced slightly more power at 700 and 800 revolutions per minute with the muffler in place than was the case when this "noise reducer" was removed. At speeds of 900 and 1,000 revolutions per minute there was but little difference noticeable; but at speeds at which the motor began to deliver its maximum power, a slight loss could be detected with the muffler in place. At 1,400 or 1,500 revolutions per minute this power loss amounted to slightly over five per cent of the total energy delivered to the dynamometer without the muffler in place.

The mufflers used in these tests showed back-pressures varying from zero to three and five pounds per square inch. Consequently it is possible that an old muffler, of poor design and clogged with soot and carbon, may absorb slightly over ten per cent of the maximum power of the motor. But the interesting feature of these experiments lies in the fact that they show the power loss caused by the muffler to occur *only* when the motor is operating at high speeds and delivering its maximum energy. But even the smallest car is capable of attaining speeds well over thirty miles an hour, and it is evident that the full power capacity of the motor should never be required in cities or towns. Consequently, it is only in the open country in which the maximum speed can be attained, or in the ascent of a steep hill in which the full power of the motor is required, that the cut-out is of any advantage in reducing the back-pressure offered to the exhaust. And even in those instances, the advantage gained by the elimination of the muffler is problematical, and is more theoretical than practical. The sound of the unmuffled exhausts at the rear of the car gives the impression of increased power, but the effect is more hypnotic than actual and it is quite possible that the car could climb that hill or attain the same speed on that straightaway as easily with the motor operating quietly as it could with the explosions making themselves evident in a stream of Gatling-gun reports trailing behind the machine.

But granting that a steep hill can be climbed faster or a higher speed on the level can be attained with the muffler cut out, what are we to think of those drivers of the high-powered cars who open the cut-out without provocation when driving through the city at a pace which could not possibly require more than a third of the power capacity of the motor? It can only be the desire to attract attention that prompts such a procedure, for the slightest movement of the throttle or spark lever will produce more power than would the most strenuous pressure on the cut-out button.

But because the cut-out has been abused is no indication that it does not possess value when properly restricted. It may be made to serve as an effective warning signal for the average pedestrian will "move" more quickly at the sound of the

short, sharp barks of the unmuffled exhaust than he will at the more musical notes of the horn. Then, too, it is the very absence of noise attendant upon the operation of the modern motor that makes it difficult to distinguish the nature of the explosions and to determine in what manner the charge is ignited in each of the cylinders. It is when it is desired to test the motor in the privacy of the garage or the country roadside that the value of the cut-out will be appreciated by the automobilist. A pressure on the button, and the explosions become distinct and any irregular firing of the cylinders can be detected instantly. Then, by turning off the ignition current from various cylinders in succession and by pursuing a process of elimination, the quality of the explosions in each can be detected and simple clues furnished for tracing any trouble to its source.

The cut-out may also be useful for preventing the occurrence of the annoying and startling muffler explosions. If the motor is turned over when the ignition current is switched off, the unexploded mixture from the cylinders will be discharged into the muffler. This will occur if the current is turned off when the motor is running at a high speed, and also when the machine is cranked preparatory to switching on the ignition current. The explosive charges that have filled the muffler will remain there until they are reached by the hot exhaust gases discharged from the motor when it runs under its own power.

These hot gases will ignite the charge in the muffler, and the violent explosions—which will at least startle bystanders, if they do not wreck the muffler—will result. If the cut-out had been opened whenever the motor was turned with the ignition current "dead," these explosive gases would have been discharged into the open air, and no muffler explosion could result when the cut-out was again closed.

The dividing line between the use and abuse of the muffler cut-out is not difficult to draw by those who have at heart the reputation of the motor car. It does seem to be difficult, however, to induce many drivers to follow that dividing line, and as "the sins of the few must be borne by the many," the present sweeping prohibitory legislation has resulted. When every driver has passed that stage in which he resembles a child with a new toy that he likes to "show off," the muffler cut-out will be a safe and valuable accessory for all motor cars. In its present status, however, the disadvantages arising from its abuse so outweigh the minor advantages that its proper use possesses, that many of even the most enthusiastic automobilists are heartily in favor of laws such as those recently passed in New York and other progressive cities.

"Heart Stopping"

(Concluded from page 73.)

To prove this, he proposes to be placed in a box, a foot of sand covering the bottom. His mouth, nostrils and ears will be filled with cotton wool and his eyes bandaged, to prevent the sand from entering his system. Then sand will be piled upon him until he is covered by at least eighteen inches of it, weighing a ton; after remaining in this position for a quarter of an hour he will be extracted alive and well. All of which reminds one of Stevenson's "Master of Ballantrae."

This athlete, interesting as he is from more than one viewpoint, got his idea of stopping his heart by reading of East Indian "fakirs." The press agent concludes with the pleasant assurance that here is another "wonder of the world."

I should like to set down certain observations regarding this phenomenon, which word I use advisedly as meaning "appearance," a term not necessarily consonant with "reality."

It is wrong to state that such muscle manipulation as that described has never before been deemed possible in medical history. Sandow, for example, in his exhibitions was able to make his muscles shimmer most amazingly in the limelight,

Many professional strong men have learned the trick.

It is possible to do remarkable things in muscle manipulation by mental concentration and exercise; the thing requires nothing more wonderful than persistency in practice during years Many of the justly praised feats seen in the circus and vaudeville are developed in this way, singleness of purpose and hard work being the only requisites Beyond this there is nothing marvelous or approaching the miraculous in them. All muscular action is dominated by the nervous system; and the nervous system has its throne in the brain; where mind most supremely manifests itself By willing it, and by constant practice, one can do wonders with his muscular system, as he can do with other parts of his body

If anyone is at a loss for an ambition in life, he may by persistent concentration and practice, so manipulate his great toe (or for that matter any other part of his body) as to increase its size out of all normal proportion Johannes Müller, in 1838, stated (and this is sound psychology to-day) that "The idea of a particular motion determines a current of nervous action toward the necessary muscles, and gives rise to the motion."

Next, as to the photograph demonstrating the decided concavity of the abdominal wall Of course the abdominal muscles are here contracted and not the stomach Protrusion of the abdomen is possible, through exercise of the mind. The literature of the *outré* in medicine contains such instances. In medical practice physicians sometimes meet women who have "phantom tumors" of the abdomen But these phantom tumors disappear when the patient is made to comprehend that she is mistaken, or should the obsession persist, these "tumors" are dissipated, and the abdomen returns to normal, under anesthesia. There are many performers who can remain under water several minutes "Odiva," it is claimed, can do this at least four minutes, which is not miraculous, but only mildly unusual. As to being buried alive for fifteen minutes, I can only repeat here that I have seen a record of the promise of such feat, but not of its fulfilment.

Statements of wonders done in the East make most entrancing romance; but they can have no standing in the court of science.

And now about that "heart-stopping." The muscles of the body are voluntary and involuntary; the former are mainly under the control of the brain and spinal cord, the latter mainly under the control of the sympathetic system But not altogether in either case For generally some cerebro-spinal filaments will find their way into sympathetic ganglia; and *vice versa*

Many voluntary movements become also involuntary; I will to take a walk; but as soon as I have got started my legs do this for me involuntarily while my mind is occupied with other things. The heart is enervated from both the cerebro-spinal system (the vagus nerve) and the sympathetic system The normal heart beat is 72 per minute, a patient fearing he has a fatal disease enters the consultation room with a pulse of 130; having been assured there is no such malady, or any occasion for such fear, his pulse beat, on leaving, has returned to normal. Drugs, again, such as muscarin and opium, will very decidedly slow the heart beat.

It seems possible then, by concentrating the will upon the heart, to quicken or slow its pulsations. But I know of no case where the function of the heart can thus be really stopped, and certainly I do not believe the idea will hold in medical science, that this can be done for twenty seconds

The alleged proof in the case before us appears to be based upon the physician having put his ear to the athlete's chest and listening for twenty seconds, watch in hand, with the result that he heard no beat. We need not question either the athlete's or the physician's good faith. But such failure to hear the heart beat does not prove there is no beating heart. The stethoscope is much more accurate than the unaided ear, and the phonendoscope still more so; the sphygmometer applied to the wrist might trace a pulse beat (which would certainly indicate a heart beat), though no beat could be elicited over the heart. I do not learn that such instruments were used. And even if, by means of the most delicate apparatus, the heart pulsation could not be appreciated, this would still not necessarily argue an absolutely non-functionating heart. Patients are moribund, comatose, for hours, with no appreciable heart beat, and yet they survive; in all that time there must have been some degree of cardiac action.

And if there were absolutely no heart beat, what would become of the blood? It cannot enter the arteries, because it has to be pumped by the heart into the arteries. It would be dammed back upon the lungs with inevitable asphyxia, and there would have to be engorged veins. But of these things no evidence whatever is vouchsafed us.

Hurrying Nature

(Concluded from page 79.)

whether success or failure has crowned his efforts. Then, possibly, he finds that one plant in a hundred has yielded something that is promising. In such crosses there is great divergence of type. It is only by selecting certain individuals in which the types desired exist and seeking to accentuate these types, that a given fruit may be built up and established. Likewise it requires many generations to get the desired characteristics fixed in a given plant Under the old system the time so consumed was such that seven years were required in establishing a new fruit. In the citrange two plant generations have been grown under the old system. The fruit that has been developed will grow anywhere in the Southern States. It takes on the nature of an improved lemon It will be more nearly a substitute for a lemon than any other of the fruits that we now have. It is still an ornamental plant and the Department of Agriculture recommends that people living in the Southern States plant the citrange in their yards as ornamental plants and derive the added advantage of being able to pick ripe fruit for citrangeade, or for any of the purposes for which lemons are used, from their own gardens at almost any time of the year. There are ten thousand people now growing the citrange trees

But had the inarch and the nurse tree been in use the citrange would have been passed through eight generations instead of two by this time. The fruit would have been much more highly developed. Many fold greater results would have been already accomplished.

But with the citrange developed as at present and the inarch discovered, there seems great opportunity in this fruit in the near future The citrange is but typical of a great number of new fruits that are just now being developed. There is the tangelo, which is a cross between the tangerine and the pomelo or grapefruit. The grapefruit is over bitter for many people and its skin is close fitting, making the meat hard to get at. The tangerine is over sweet and the kid-glove skin almost falls from it. It is easy to imagine the fruit that would result from this cross. By selection and combinations of the desired qualities by cross breeding the specimens, the scientists believe that they will be able to establish fruit that will have just the right amount of tartness and just the desired kind of skin. Already there are some specimens of the tangelo growing in Florida that are said to be in every way superior to the orange. With the use of the nurse plant and the inarch great things are expected in the next few years.

There is another application of the inarch that is just now being tested. Delicate fruits such as the lemon that refuse to grow except in a few spots in the very warmest of the United States, are being inarched upon such cold resistant plants as the mock orange. It is known that it

is the sap control of plants that protects them from frost. The lemon, for instance, keeps its leaves full of sap throughout the winter. When the weather gets sufficiently cold this sap is turned into ice and the plant is as a consequence killed. But where the lemon is inarched on the mock orange, which by nature has a sap control adapted to cold climates, the story is different. When cold weather approaches the mock orange roots refuse to send the sap into the top of the tree. It, therefore, fails to freeze and is not killed by the cold. So it is hoped that by inarching the orange, the grapefruit, the lemon, or any other of the citrus fruits upon the sturdier, related growths farther north, the danger line may be crowded into materially higher latitudes, and that even the citrus fruits of the present may be grown in a vastly wider range in the United States.

The inarch may also be extensively used in rose culture. When scientific plant growers develop a hybrid rose through this same method of cross fertilization they have been forced to wait for years until it came into flower. Some of the most delicate blossoms grow on stalks that are also delicate and slow to develop. Such seedlings may be inarched on the stalk of some sturdy and well rooted rosebush and vigorously crowded into blossom. Its virtues or lack of them may be sooner determined.

There are those who may say that practically the same things may be accomplished by the old process of budding or grafting. This is, however, not the case. Before a plant may be budded onto another stalk it must have acquired considerable age in order to produce the right sort of buds. The process of budding is most delicate and the results are in question. It is vastly slower than the inarch. It is vastly more difficult. The Government plant growers state that any intelligent man, though entirely inexperienced, can readily accomplish the inarch, while the baffling process of budding requires the most exact scientific skill.

The man who has been the moving spirit in the inarch work of the Government is George W. Oliver, who has charge of the Government hothouses at Washington. Mr. Oliver, like so many of the great gardeners and agriculturists of the nation, is a Scotchman. The greater part of his life has, however, been spent in the United States, and for many years his has been the ceaseless care that has kept the temperatures right in the Government hothouses for growing plants that range from the Arctic circle to the equator. This transfusion of the energy of one plant to another is his final success, but is merely typical of the manner in which he works the things of the vegetable kingdom and succeeds where there would seem hope for nothing short of witchery.

The "Commonwealth"-"New Hampshire" Collision

(Concluded from page 78.)

watch, all were asleep on both ships, the crews repaired quickly and quietly to their stations, and eye-witnesses on board each vessel state that there was no confusion of any kind. The "Commonwealth" backed off, proceeded to her landing, and discharged passengers and cargo. The crew of the battleship at once set about preparations for effecting the necessary temporary repairs to enable the vessel to proceed to the nearest navy yard.

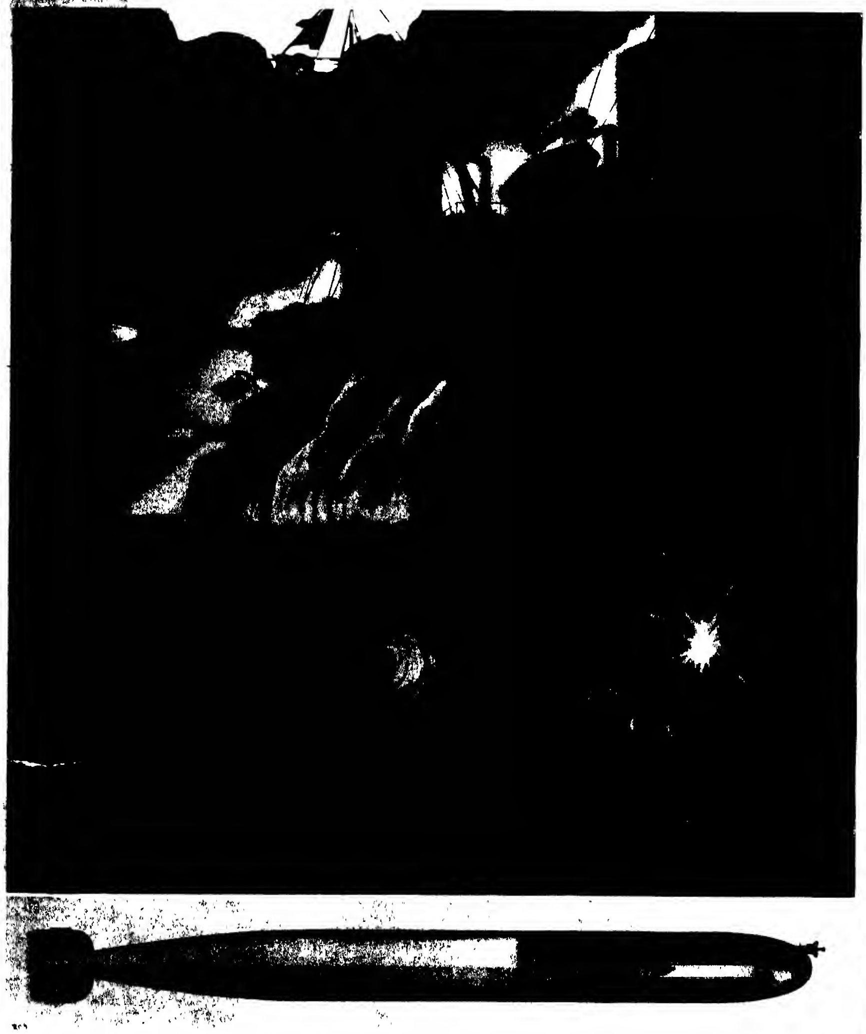
These consisted of two wooden bulkheads securely bolted to the ship's sides and decks and suitably braced to withstand heavy seas from aft if necessary. By working day and night a thoroughly efficient watertight job was completed entirely by the vessel's crew in four working days. Here again theory is borne out by practice, showing that the modern battleship actually is a self-contained and independent unit, capable in an exigency of executing even such extensive repairs as were evidently necessary in this case by means of her own force of mechanics, properly directed by her own efficient officers.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

[illegible] CVII. [illegible]] NEW YORK, AUGUST 3, 1912 [10 CENTS A COPY $3.00 A YEAR



How the Davis torpedo would pierce five opposing bulkheads of steel, passing through one of the coal bunkers and bursting in a boiler room.

A NEW FORM OF UNDERWATER ATTACK.—[See page 94.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, AUGUST 3, 1912

Published by Munn & Co., Incorporated Charles Allen Munn, President
Frederick Converse Beach Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico Cuba and Panama	
Subscriptions for Foreign Countries one year, postage prepaid.	4.50
Subscriptions for Canada one year postage prepaid .	3.75

The Scientific American Publications

Scientific American (established 1845) . . . . per year,	$3.00
Scientific American Supplement (established 1876) .	5.00
American Homes and Gardens	3.00

The combined subscription rates and rates to foreign countries including Canada will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short* and the facts *authentic* the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Wanted—A Chief for the Bureau of Chemistry

MONTHS have now elapsed since Dr. Wiley resigned as chief of the Bureau of Chemistry. That no successor has as yet been appointed may be attributed to the fact that it is no easy task to induce a scientist of commanding position and personality to accept an annual salary far less than the sum which he could earn in a year in private practice. Moreover, the conditions under which work is now carried on in the Bureau of Chemistry would be intolerable to any really scientific man. Selfish food manufacturers are bound to do all in their power to make his official life as unbearable as possible, and the spirits that now dominate the work done by the Bureau of Chemistry in passing upon the legality or illegality of the doings of food and drug manufacturers would hardly be in sympathy with a real scientific chief. We cannot imagine that any self respecting scientist who has a reputation to sustain would be willing to accept the position without absolute power to reorganize the entire bureau, and to shape its investigations in such a way that its work will be respected. Yet, not until a thorough reorganization is effected, not until the old meaningless divisions of the Bureau of Chemistry are abolished, not until the rank and file of the Bureau of Chemistry realize that at last they may work with the impersonal, unbiased, open minds of chemists in a university laboratory of the highest standing, is it likely that the Bureau of Chemistry will become a truly effective and valuable institution. When that reorganization is effected it will no longer be necessary to maintain at an expense of tens of thousands of dollars per year a referee board to check up the work of the Bureau of Chemistry. As matters now stand, the Bureau of Chemistry has the lamentable distinction of being the only department of the Government that cannot stand on its own scientific feet, and that requires scientific supervision by another body.

At present wealthy dishonest food manufacturers find it no difficult task to escape the punishment which they so richly deserve. Opposed by well meaning but incompetent employees of the Bureau of Chemistry they find it no difficult matter in Court to offset their unscientific evidence by expert testimony, which can be bought at a market price, and which is at least as good as the evidence offered by the Government. That is why the admirable Pure Food and Drugs Act is not at present as effective as it should be. Not until a strong man is appointed, a man who realizes the enormous responsibility of caring for a nation's health, will that excellent piece of legislation become what it should be.

Scientific men naturally shrink from the kind of publicity which the reorganization and administration of the Bureau of Chemistry will bring with it. For that reason it may be necessary to appoint some fearless, honest, public-spirited civilian, who is in full sympathy with the ideals and methods of scientific men.

Interference and Aeroplane Disasters

THREE very recent accidents to aircraft have furnished food for serious reflection, and they are all the more important because we appear to be on the eve of a wide adoption of aeroplanes of one or another form for military and naval uses. In addition to this, these mishaps are likewise lessons to the aviator generally. In brief, we are brought face to face with the fact that speeding aeroplanes are a danger to one another even though maneuvering at apparently safe distances.

On the 20th of June, Mlle. Helene Dutrieu, while driving a monoplane at Aix-les-Bains, hit an "air hole," as the descending air current has been nicknamed, and fell to the ground. Her fall, however, was checked by her machine landing on top of two other monoplanes ascending at the time, and all three of the aeroplanes were thrown to the earth.

Sixteen days later, at Villacoublay, near Paris, Lieutenants Briez and Burlez, both of the French army, set out on a flight toward Belfort, a point on the eastern frontier. Lieutenant Briez got the start of his fellow aviator, and had reached a height of five or six hundred feet before Lieutenant Burlez overtook him. Lieutenant Burlez was traveling a hundred feet higher up and faster than his brother officer. Just after the upper monoplane swept ahead, a descending column of air—undoubtedly the reaction due to the overhauling and higher monoplane—struck one of the wings of Lieut. Briez's machine and destroyed its equilibrium so suddenly and forcibly that the latter aviator and his aeroplane were dashed to the earth. Lieut. Burlez was thus the innocent cause of the disaster which nearly cost his companion-in-arms his life.

It is quite probable that Mlle. Dutrieu's fall may have been brought about by the aerial perturbations set up below her by the maneuvering of the two lower monoplanes—in this respect the promoting agitation coming from beneath instead of from above as in the case of Lieut. Briez's serious plunge. We do not know what were the speeds of the two disturbing aeroplanes at Aix-les-Bains, but it is not hard to see how doubling the cause of the aerial commotion would naturally promote greater reactions, and the gravity of this under any circumstances might be augmented if the same factor of agitation occurred nearer the ground. This is broadly on the principle that a bodily displacement of the air, as that occasioning sound, for instance, will carry its effect higher than a similarly disturbing force exerted at greater altitude and transmitted downward. In the case of the Burlez-Briez accident, we are left to speculate as to what might have occurred if the lower rather than the upper monoplane had overhauled and passed onward at greater speed.

Only a few days ago, the Italian aviator, Guidoni, while maneuvering his hydro-aeroplane aloft in the Gulf of Spezia, drove his machine across the wake of the battleship "Dante Alighieri," which was at that time making about twenty-three knots an hour. The high speed of that battleship created such perturbations in the air that Guidoni's machine, although some distance astern, was capsized and tumbled into the water. This is especially suggestive to the naval man, because the use of the hydro-aeroplane is proposed in conjunction with sea-going ships as mobile launching and landing places for these hybrid scouts. The tumble which Signor Guidoni got under auspicious conditions of wind and water does not prophesy favorably for the employment of aeroplanes with moving vessels and in more boisterous circumstances of wave and weather.

But what all three of these illuminating mishaps emphasize is the wide zone of disturbance set up by the reactions of the air following a moving body. Model basin experiments and the influence of ships in motion have given us convincing evidence of the force of the suction created between neighboring vessels under way. Because of the denser character of the medium supporting floating ships, it is reasonable to suppose that the action of readjustment of the surrounding water is confined to a relatively restricted zone when compared with similar disturbances created in the air. And yet we know that moving craft have affected one another by suction when separated several hundred feet. Because of the compressibility and the far lesser density of the air, it must be plain that a flying machine—not a balloon—is drawing for support upon a much wider atmospheric zone than a similar weight borne upon the water's surface. Again, the compressibility of the air is a prime factor in sustaining a heavy body in motion aloft, and the re-expansion of this air in the wake of the aeroplane must produce perturbations which carry their influence correspondingly farther because of the very nature of this medium. Therefore, at first blush, it seems that the flying machine in flight must be given a wider berth by another aeroplane than heretofore imagined. The question is, what will this impose when air craft of this sort undertake to operate in squadrons? Formations of this kind may logically follow the adoption of the aeroplane gun.

It has been intimated by some students of this problem that the propellers of the aeroplanes were principally responsible for these disturbances leading to the formation of falling columns of air, otherwise popularly known as "air holes" or "air pockets." That there is good reason to doubt the entirety of this perturbation being due to the propellers has been disclosed by the towing tests of models in the experimental basin. The researches of this character have shown pronounced suction to e[illegible] vessels without screws, and Na[illegible] has declared his belief that [illegible] momentous factor in promoting [illegible] that a somewhat kindred co[illegible] between the propeller of a fl[illegible] porting planes which are be[illegible] bluntly against the opposing a[illegible] it is contiguous to these sur[illegible] jected to its greatest comp[illegible] the points of suspension, a[illegible] the wake of these planes [illegible] of the vertical agitation [illegible] recent accidents suggest a [illegible] gation which might be p[illegible] art of aerial navigation, [illegible] these casualties can not ri[illegible]

The Protection of M[illegible] from L[illegible]

NOWHERE else do [illegible] the atmosphere assu[illegible] fying a character a[illegible] mountains, and the danger [illegible] of the formidable obstacles [illegible] tion of mountain observato[illegible] of the *Comptes Rendus*, M. J[illegible] founder of the Mont Blanc o[illegible] graphic description of these [illegible] and some suggestions for averti[illegible]

It is a mistake to suppose that t[illegible] by snow suffices to protect from [illegible] was illustrated last August, when [illegible] the Society of Observatories, bui[illegible] of Mont Blanc, was struck by li[illegible] results to one of its occupants. T[illegible] wood, roofed with sheets of copper, [illegible] vided with lightning rods. It was p[illegible] in snow at the time of the disaster. T[illegible] was struck in 1909, although it did [illegible] metal roof.

The famous Janssen observatory on [illegible] was repeatedly struck, although it bo[illegible] lightning rods, connected by cables to [illegible] few hundred feet distant. This building [illegible] and was built on the snow. The effects of [illegible] were extraordinary and appalling; the m[illegible] ware was frequently melted or perforated; [illegible] and nuts in the walls were melted; the wood[illegible] charred; the metal cap of the large telescope [illegible] pierced with holes, etc.

In 1903 a guide, one Felix Boson, witnessed a [illegible] liant electrical discharge in the form of ribbons [illegible] fire which for two hours and a half continued to [illegible] across the interior of the building, proceeding [illegible] one of the cables connected with the lightning [illegible] In 1902 a ball of fire as large as a pigeon's egg [illegible] seen to move slowly across the room, then retreat[illegible] a distance and explode, giving a violent shock to [illegible] persons present. In 1907 a series of lightning st[illegible] occurred one evening at nearly regular intervals [illegible] a few minutes; each stroke produced a deafe[illegible] noise and was attended by sparks like fiery serpe[illegible] which shot through the observatory in all directi[illegible] This process continued nearly an hour. Such o[illegible] rences appear to have been common at the Ja[illegible] observatory, which must have been a far from tran[illegible] place of abode for the savants who carried on his[illegible] researches at this elevated spot.

It is evident that lightning rods are entirely ina[illegible] quate to carry off the enormous discharges of mount[illegible] thunder storms.

In contrast to the experiences of the former Jan[illegible] observatory, it is most encouraging to learn [illegible] M. Vallot's own observatory, on another part of [illegible] Blanc, has never once been struck by lightning, du[illegible] its thirteen years of existence. This structure is b[illegible] on the solid rock, and is completely incased in [illegible] sheets of copper, which are connected with a n[illegible] of multiple-point lightning rods, grounded in the [illegible] The whole system of metal thus forms a Far[illegible] cage, which so fully carries off the lightning disch[illegible] that even during the most violent thunder st[illegible] no electrical effect of any kind is observed inside [illegible] building, despite the presence of numerous met[illegible] instruments which are not connected with the light[illegible] rods. M. Vallot's observatory therefore forms a v[illegible] ble object lesson to anyone who is contemplating [illegible] erection of a mountain observatory.

Danger in Metal Wine Vessels.—A note of warning [illegible] regard to the use of metal utensils for the measuri[illegible] serving, or holding of wine is sounded in the *Mon[illegible] Vinicole* by M. L. Mathieu. In general only co[illegible] plated copper, or silver should be permitted in [illegible] rooms, cellars, etc., though plated "tin" may be [illegible] safely under certain special conditions. Zinc is espe[illegible] prohibited, since it forms with wine salts which are [illegible] ble in the wine, and which not only impair the flav[illegible] lending a disagreeable metallic flavor, but are [illegible] toxic even in very small quantities.

Science

The Temperature of Flowing Lava was measured during the eruption of Etna last September by Prof. G. [illegible] with a Fery radio-pyrometer. Where the lava was still glowing red, temperatures ranging from 795 to [illegible] deg. Cent. were observed.

[illegible] Sizes for Scientific Books.—The council of the International Association of Chemical Societies, [illegible] in Berlin last April, unanimously approved Prof. [illegible] suggestion in favor of a uniform size, or series [illegible] for chemical publications, and recommended [illegible] affiliated societies adopt the universal format [illegible] centimeters, or a format bearing some logical [illegible] this. All publications of the Association will [illegible] conform to this size.

[illegible] of Rain Making.—Prof. Willis L. Moore, [illegible] Weather Bureau, has issued a statement in [illegible] the efforts of a prominent breakfast [illegible] of Battle Creek to produce rain artificially. "[illegible] hardly seems necessary for the Weather Bureau at this late day," says Prof. Moore, "to enter into elaborate arguments in order to convince the public of the utter futility of this and every other method so far proposed for artificially producing rain."

Natural and Artificial Asphalt.—In several European countries, and especially in Austria, artificial asphalt is manufactured and used; but up to the present there has been no direct comparison of the two from the purely chemical standpoint. Recently, however, Gawalowski has made analysis of true Barbados asphalt and of the artificial, with the following results: Specific gravity, natural, 1.0143; artificial, 1.393. Hardness according to Mohs, natural, 1 to 2 deg. M.; artificial, 2 to 3 deg. M. Hardness according to Breithaupt, natural, 1 to 2 deg. B.; artificial, 3 deg. B. Soluble in petroleum, natural, very easily; artificial, with great difficulty, slowly and incompletely. Soluble in benzin, natural, very easily and completely; artificial, with great difficulty, slowly and incompletely. Soluble in benzol, natural, very easily and completely; artificial, rather easily. Solubility in wax, natural, not known; artificial, in 5 to 7 days, leaving an amber-like remainder. The solution in benzin of the Barbados natural asphalt gives a beautiful brownish varnish layer, which dries in about ten minutes; that of the artificial asphalt, however, does not; therefore the first is to be preferred for fine varnish.

The Bulk and Weight of Our Rainfall.—Mr. George A. Lindsay, writing in the Transactions of the Academy of Science of St. Louis, gives some interesting statistics of the rainfall of the United States, not expressed in the conventional inches of depth, but in the aggregate volume and weight of the moisture that falls annually over a given area. To anyone who is familiar only with the customary method of stating rainfall, it is somewhat startling to learn, for instance, that 43.9 cubic miles of rain fell in Missouri during the year 1896. This is decidedly more impressive that the statement that the rainfall was about 40 inches. In the same year 1,296.4 cubic miles of water is computed to have fallen over the whole area of the United States, and the average annual rainfall is somewhat greater than this; viz., 1,308 cubic miles, weighing 6,000,000,000,000 tons. As an illustration of the fact that most of the water that falls as rain never reaches the sea through the medium of drainage, but is evaporated from the land, Mr. Lindsay shows that the discharge of the Mississippi River at St. Louis is but little greater than the volume of rainfall over the State of Missouri alone, despite the enormous area drained by the river above that point.

Street Dust and Street Pavements.—In a recent article published in *Hygiene* Dr. Rasser draws attention to the considerable danger connected with street dust, the action of which on the human organs of respiration is responsible to a great extent for the origin of tuberculosis and similar diseases of the lungs and wind-pipe. But apart from this kind of trouble, dangerous chronic inflammations of the eye should be put down to the action of street dust. In fact, an increase in the frequency of catarrhs has been observed with continued dry weather and a reduction on the occurrence of the first rain. Under these conditions road engineering, apart from its technical task, has primarily to fulfill a sanitary task. As the production of dust depends on the fixing of roads, a pavement complying with all hygienical requirements should be looked for. Asphalted streets would seem to comply with most of these conditions, provided there be an extensive and thorough removal of waste matter followed by an abundant sprinkling of the road surface. Caoutchouc pavement, as used with especially satisfactory results in London, would seem to be most desirable. Dr. Rasser does not seem to think very highly of the sprinkling of roads with chemicals, such as salts and tar. An ideal means of laying street dust which has been suggested of late years is sprinkling with a solution of sulphite pitch in water, which would seem to avoid any dust for at least six weeks. Sulphite pitch is obtained as a by-product in manufacturing cellulose.

Electricity

Electrical Irrigation.—At Good Ground, L. I., Mr. Emilio Olsson is conducting some experiments with his system of irrigation, described some time ago in the Inventor's Department of the SCIENTIFIC AMERICAN. The poorest soil in Good Ground has been selected for the test. One plot is irrigated with water alone; a companion plot with water electrically charged, according to the Olsson system. The results of the comparative growth will be watched with interest.

An Electrically Fired Iron Furnace.—The electrical production of pig iron has been tried from time to time in Scandinavia, the poor coal supply of the country and the availability of cheap electric power inviting such experiments. In a powerful reducing plant erected at Trollhätten, investigations lasting six months have recently been concluded. The energy was supplied at 10,000 volts, three-phase, and transformed to two-phase current with a pressure variable in each phase from 50 to 100 volts, and currents of 3,000 to 18,000 amperes were employed in the furnace. The best result attained was 2,241 kilowatt-hours per ton of iron cast, of which 1,596 kilowatt-hours was expended in useful work, showing an efficiency of 71.77 per cent. The furnace is designed to produce 7,500 tons of pig iron during eleven months of the year.

Communication with Railroad Trains by "Railophone."—A demonstration of the "Railophone," an invention for actuating signals and effecting other mechanical operations on moving trains, was recently given on an English railway. Briefly the system comprises an insulated wire laid alongside the track and connecting to apparatus at signal cabins and stations, and of a pair of coils wound on frames around the railroad cars, one for sending and the other for receiving. The system operates by induction, and an essential feature is a relay which can only be operated by the periodic impulses which convey the signals and is not affected by the nonperiodic vibrations caused by the movement of the train. Among other feats accomplished during the tests were the stopping of a train which had been allowed to run past a danger signal and the transmission of a message and its reply between a station and the train.

The Hamburg Electric Railroad.—The new Hamburg elevated and underground electric road is a remarkable piece of engineering and electrical work and represents the most recent progress on the continent. It is made up of viaducts and bridge structure for about one third the length, and a quarter of the length is underground. The remainder is built of embankments, in part, between masonry walls. Trains are made up entirely of motor cars, each one having two 100 horsepower motors, and the controlling can be done from each of the end cars. The total length of the line is about 16 miles, with standard gage tracks, and the distance between stations is 2,650 feet. The station platforms are 200 feet long. An automatic system of electric lighting is used so that the lights come on only when passing through the underground part. Three-phase current at 6,000 volts is supplied by a special plant at Barmbeck, sent to two sub-stations at the principal station of Eppendorf, where it is transformed to 800-volt direct-current. This is employed on the third-rail system, but the contact shoe works upon the under surface of the rail.

A Marvelous Electrical Discovery.—In a brief and revolutionary monograph presented to the French Académie des Sciences, Prof. Jean Becquerel, the great physicist, announces a discovery which, when it is confirmed, as it certainly will be, will prove to be of untold importance in the practical workings as well as the study of electricity. It is well known that if a thin strip of metal is fastened to a glass plate placed between the poles of an electro-magnet in such a way that the plane of the strip is at right angles to the lines of force of the magnetic field, a current passing through the strip from end to end is deflected to one side or the other, according to the type of metal of which the strip is composed. Thus the current in a strip of zinc, iron, or cobalt is deflected toward the right, but to the left if nickel, gold, or bismuth is used. The effect is especially striking when bismuth is taken to make the strip. From its discoverer, Dr. Hall, of Johns Hopkins University, this has been named the "Hall effect." It has been held as strong evidence that there are such bodies as positive electrons. Dr. Pfund of Baltimore is, together with Sir J. J. Thomson and others, convinced that the presumptive evidence in favor of the existence of positive electrons is too definite for further doubt. M. Becquerel now proves that if the Baltimore experiment be carried out with a piece of bismuth in liquid air, the effect is made more conspicuous. Then, too, if the magnetic field be increased to above 3,500, the deflection abruptly becomes positive instead of negative. This upsets all known mathematical and physical theories that would make the negative electrons the only carriers of electrons in metals. It again changes our views of the question of what negative and positive electricity really is.

Aeronautics

A New French Aero Club.—Blériot, who resigned on July 3rd last from the Aero Club of France, has started a new organization, called the Aviators' Friendly Association. Among his adherents are many famous aviators and designers.

France and the Gordon-Bennett Cup.—There has been much activity at Chalons. The elimination trials for the Gordon-Bennett cup have shown that Vedrines will, in all likelihood, represent France. Recently he covered 200 kilometers (about 120 miles) in one hour and twenty-four minutes.

A Berliner Engine.—Mr. Emil Berliner of Washington, D. C., well known in connection with his telephone and other important inventions, has patented a rotary gas engine which has a rotating crank case carrying a cylinder which rotates with it, and a piston in the cylinder with the ports of the cylinder so disposed as to be uncovered by the piston as it reaches the end of its stroke following explosion.

A New Aeroplane Construction.—Spencer M. Brown of Portland, Ore., has patented an aeroplane, No. 1,032,-587, which has a pair of upwardly inclined wings which are united at their lower edges and each of the wings is broken into transversely disposed sections, with each alternating section along the inner edge of each wing inclined upwardly to form with the other section a truss-like framework.

A Sixteen-hour Journey in a Dirigible.—The French dirigible "Conte" has made a trip lasting sixteen hours and twenty-four minutes. Under the direction of M. Cohen the craft left from the vicinity of Meaux and Fontainebleau, returned over Paris in the dead of night, then reached Etampes, Arthenay, and Chartres, finally to return to Issy-les-Moulineaux. The maximum altitude attained was over 6,500 feet.

Resistance Tests With Blériot Machines.—The French military authorities have been making some remarkable tests with Blériot monoplanes. On a special railway train a Blériot monoplane was mounted in such a manner that it could assume all possible positions taken in ordinary flight. The train was driven at a speed of 72 miles an hour over a 5-kilometer stretch of railway.

Investigating Accidents.—The Public Safety and Accidents Investigation Committee of the Royal Aero Club promises to fulfill a useful purpose in the development of aviation. Judging from the celerity with which it proceeded in investigating the accident that occurred recently at Brooklands, in which an aviator and a passenger lost their lives, we may expect to learn more of those weaknesses in construction and defects in handling to which so many deaths are due.

German Military Aeronautics.—The German Minister of War has bought for the army the Siemens-Schuckert dirigible airship. In trials conducted last February the vessel attained a speed of 43 miles an hour. The dirigible "Z-2," stationed at Cologne, a Parseval airship, and fifteen or twenty aeroplanes will take part in the forthcoming maneuvers. The dirigible "Z-3," which was badly damaged at Friedrichshafen, is now completely repaired.

The Blériot Berline.—The aerial taxicab or berline, built for Deutsche de la Meurthe by Blériot, has been making some remarkable flights. The 100 horse-power motor has been removed, and in its place a 140 horse-power engine has been installed. Loaded with about 650 pounds of ballast, it carries a cargo equivalent in weight to that of four passengers besides the pilot. As yet, no four passengers have ventured to take their seats in the taxicab body.

The First Aerial Derby.—The English Aerial Derby showed that flying can be made a real sport. More enthusiasm was invoked over a contest for a 100 guinea trophy and cash prizes of £450 than was aroused even by the $50,000 prizes of the *Daily Mail* in the past. It is safe to say that millions saw the race. At the London Aerodrome, we are assured by our contemporary *Flight*, at least 45,000 paid for admission to the inclosures, while on the adjacent slopes several thousands more were massed. The same state of affairs applied at every point around the course of 81 miles. Hamel, one of the contestants, stated that Esher Common was absolutely black with people.

Guiding Torpedoes from Aircraft.—In patent No. 1,032,394 Bradley A. Fiske, U. S. navy, presents a method and apparatus for delivering submarine torpedoes from aircraft in which the torpedo is first transported through the air to a point of desired proximity to a target by means of an aircraft and then the torpedo is trained in the desired direction, after which the propelling mechanism of the torpedo is started, and then the torpedo is released to fall by gravity to the water. In the apparatus, a strap is employed for retaining the torpedo below the aircraft and a manually controlled lever releases a latch for said strap, the said lever also actuating transmitting mechanism to operate the starting device for the propelling mechanism of the torpedo.

On striking the timber the motorcycle acquires a mounting position.

Position of the machine two feet above the testing track on a ten foot leap.

Machine's position in alighting after striking the timber obstruction.

Testing a Motorcycle

A MANUFACTURER of motorcycles in the Middle West experienced considerable difficulty in his early days with spring forks. He was using a very high grade of steel, but nevertheless the forks would sometimes break in the hands of bicycle users. They employed consulting engineers to find out what was the matter. The verdict was that the spring forks were the best that could possibly be made. One engineer, however, had made a change—not a change in design, but a change in material—substituting a steel somewhat more brittle. That seemed very foolish. In order to prove to the manufacturer that he was right, he offered to test the motorcycle in the manner shown by the accompanying illustrations. He rode around a test track, banked at the turns, at a speed of five to sixty miles an hour, striking an obstruction (a four by four timber). Every time the motorcycle encountered the obstruction it leaped into the air approximately two feet and alighted ten feet farther on. The test is now being performed by several testers daily.

Transatlantic Wireless Telegraphy Without Antennæ

HUGE towers for carrying up the antenna system to sufficient height above ground have been built at several places, e. g., Poldhu, Clifden, Glace Bay, to make transatlantic radio-telegraphy possible. The highest building in the world, the Eiffel Tower (about 1,000 feet in height), has in its turn been utilized for the purposes of wireless telegraphy, while the sending tower of the Nauen radio-telegraphic station was recently raised from 330 feet to 660 feet in height, thus allowing the African colonies to be reached from Berlin by wireless telegraphy.

It will therefore be readily understood that experiments recently made in Berlin with a new arrangement due to Prof. Zehnder should arouse more than usual attention. The new scheme, in fact, does away with any antenna. An ordinary insulated conductor wire carried on telegraph poles is connected at both ends to the ground, with or without the intermediary of Leyden jars. The total length of wire between the two ground connections should at most equal one half wave length of the alternate current employed. If, for instance, the wave length in air be 4,500 meters (2.8 miles), which is about sufficient for transatlantic operation, the ground connections would have to be located at 900 meters (2,952 feet) apart in the ground and only 250 meters (820 feet) in water. This conductor is excited as usual in its central part by a Braun vibratory circuit, the length of which is tuned to the frequency of the vibratory circuit.

The new scheme at the same time constitutes a system of directed wireless telegraphy, the direction of the wire itself being the most favorable for sending. In a like manner, if a receiver be substituted for the exciter, the preferential receiving direction will be given by the wire.

This scheme, in spite of the provisional character of the arrangement, allowed telegrams to be sent with small-size sending apparatus and without antennæ, to many hundreds of miles. Herr Kiebitz, of the German Telegraph Department, in his experiments on behalf of the department transmitted radiograms from Berlin to Norddeich and with the ordinary type of receiver, received in Berlin messages that came across the Atlantic Ocean from Glace Bay, Nova Scotia.

One advantage of the scheme suggested by Zehnder is the possibility of installing the whole of the apparatus in the interior of a building, fortress, man-of-war, etc., thus protecting it against destruction by storms, gales or the enemy's guns, which will be found of inappreciable value in warfare. Incidentally these experiments appear to show that the transmission of electric waves in great part occurs through the earth itself.

The Curtiss "Flying Boat"

A New Type of Hydro-aeroplane

SINCE he closed his camp and aviation school at San Diego last spring, Glenn Curtiss has been steadily at work at his home in Hammondsport, N. Y., making further improvements upon his hydro-aeroplane. The result of his recent experiments is shown in the photographs reproduced on this page, which give a good idea of his latest combined boat and biplane, known as the Curtiss "Flying Boat."

This boat is a single step hydroplane, 26 feet long, 3 feet wide, and having sides 3 feet high. It is surmounted by a regular Curtiss biplane, having planes of 30-foot spread by 5½-foot depth between the planes. The planes contain a total supporting surface of about 320 square feet, and support, when in flight, a total weight of about 1,000 pounds. As many as four people can be carried comfortably. One of our illustrations shows a man in a bathing suit lying on the deck of the boat behind the planes in addition to the pilot and passenger in front.

The power plant consists of an 80 horse-power Curtiss 8-cylinder, V-type engine and single propeller mounted high up between the main planes at the center. The motor is mounted sufficiently high to provide a liberal clearance between the end of the propeller blades and the boat, the propeller being just back of the main planes, as usual.

Above the tapered hull of the boat, at the rear, is a vertical fin terminating in a large vertical rudder. The tail is placed about half way between the boat and the top of this fin, and extends out on each side of it. The horizontal rudder consists of two hinged flaps at the rear of the two halves of the tail. No front elevator is provided, so that the pilot has a clear view in front over the spray hood that is fitted. The balancing planes are at the rear, half way between the main planes. Inclined cylindrical floats are fitted below the ends of the lower plane in case the machine tips in making a quick turn on the water.

This new flying boat of Curtiss's makes aviation perfectly safe, as one can travel 50 miles an hour on the surface of the water, or 60 or more miles an hour a few feet above the surface. It will open up to the motor boat enthusiast heretofore unnavigable streams. In fact all the unused canals and shallow rivers of the country can be skimmed over always with complete safety by the yachtsman-aviator.

The passenger lies well to the rear.

The new Curtiss hydroaeroplane in flight.

The Current Supplement

IN the current issue, No. 1900, of the SUPPLEMENT, Dr. Gradenwitz gives an illustrated account of the manufacture and testing at high tension of porcelain electric insulators.—W. R. Ingalls, the well-known metallurgist, writes on the electric smelting of zinc.—Our Berlin correspondent gives a description of the new railway station in course of construction at Leipzig, which, when completed, will be the largest in Europe.—Dr. Zahm concludes his excellent article on aeromechanics.—An instrument by means of which the blind are enabled to perceive light through their sense of hearing was recently exhibited by M. Fournier d'Albe, of Birmingham, England, at the Optical Convention. An account of this is given in the current issue.—Some very excellent points are made with regard to the Oldfield bill in comment reproduced from *Metallurgical and Chemical Engineering* for July.—A new method of preserving eggs, which is said to possess altogether superior merits, is described by our Paris correspondent.—The closing article deals with experiments on the durability of tool steel.

A New Andean Railway

THE American minister at La Paz, Bolivia, reports that on May 15th the railway recently built from Potosi to Rio Mulato, a station between Oruro and Uyuni on the main line, between La Paz and Antofagasta, was officially opened at Potosi by the president of the republic and his cabinet. This railway, surveyed, planned and built by American engineers and contractors, is regarded as a marvelous piece of construction. At one point the altitude is about 16,000 feet, making it, the minister states, the highest railway in the world. Not only was the road very costly to build, but it will be costly to maintain, apparently out of all proportion to its prospective business. There is not a village or hamlet between the terminal points; and Potosi, which had once a population of 200,000, has now fallen to 25,000.

Rebuilding Messina

AFTER the great earthquake of December 28th, 1908, which completely destroyed the city of Messina, the few survivors, aided by international philanthropy, erected temporary wooden buildings south of the old city, and here commercial and official business has since been carried on. On the original site of Messina not a single building had been erected or even begun up to the end of last year. Now, however, preparations for rebuilding the city are well under way. Since July, 1911, the systematic removal of the débris from the streets has been in progress. The plan of reconstruction includes a raise in the level and an extension of the harbor front.

From Clay to Bronze

The Craftsman's Part in the Art of Sculpture

By C. H. Claudy

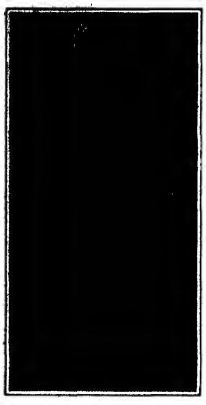
"THE clay is the life, the plaster death, and marble the resurrection." A famous artist's words, descriptive of the forms through which a statue must pass whether it end in the white marble which is so poetically referred to above, or in the sterner and more enduring bronze of the heroic size statues, too big for marble work.

Everyone knows, of course, that a statue is first modeled in clay by the sculptor, whose deft tools and skilly work out the likeness, the life—sometimes the soul—of the subject. Then, in some way, usually passed over by the expression "casting," the clay is reproduced in bronze. Of the intermediate steps, the general public knows little, yet those intermediate steps are of the utmost importance and of great interest. It is in them, as well as in the casting of the molten metal, that the craftsman steps in and replaces the artist—the place where the most highly skilled labor is necessary, and where the greatest artistic skill in statue making has no value.

When the wet clay, preserved from day to day by being constantly shrouded in wet cloth, is finished and has the life-like form of the subject to the utmost of the artist's expertness, the craftsman prepares to make a mold from the clay. This mold is not used to make the bronze cast, but it is intended to be employed for making a plaster cast of the clay. From this plaster cast, the final mold is made in which the bronze, streaming and hot, is poured. The great interest in this operation of making the plaster mold and plaster cast comes from the fact that there is no retracing the steps once made—no second chance if the first one fails. To make the mold, the clay is first stuck full of thin pieces of tin! This apparently disastrous proceeding is necessary, for the mold, when made, must be in two or more pieces and some division between the two is necessary. So many thin pieces of tin are used, and are ruthlessly stuck into the clay, forming raised partitions along what are to be the division lines of the mold. The strips overlap and project six inches from the clay. The clay is then wet down and then covered with a thin, cream-like plaster of Paris mixture, which has been highly colored with some pigment; it makes little difference what color it is, so that it is easily distinguished from white. The reason for this first colored layer is seen later on. The liquid plaster is sprinkled and thrown on the clay statue, the greatest care being taken to cover every part of it completely, and to have the liquid penetrate into all the folds, crevices and indentations of the clay. On the skill and care with which this is done depends the success of the mold.

As soon as this first colored layer has been finished, and set, it is built up to a thickness of perhaps an inch with thicker plaster of Paris, uncolored this time. Next, a framework of pipes, wood, wire and rods is erected about the statue in such a way that each part of the mold, as indicated by the division lines of projecting tin, has its own set of braces. Once these are in place, the making of the mold proceeds rapidly, with an assistant mixing plaster of Paris in a bowl, and the craftsman-caster throwing and kneading the wet masses onto the plaster covering the clay, being particular that the mold is built up the thickest where the most strains will come, where it may be five inches or more thick, and permitting those portions where little strain may come to remain not more than an inch or two thick. The iron rods and pipe frameworks are well embedded in the plaster so that they, themselves, will take most of the strain when it becomes time to lift or move parts of the mold.

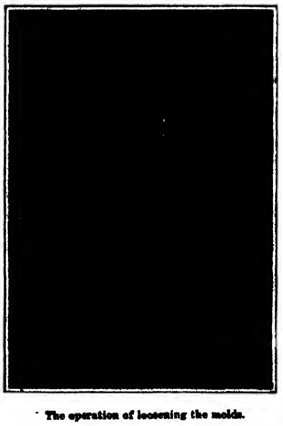
When the caster is through this part of the work, the whole is allowed to dry or set for at least twenty-four hours, and frequently longer. Next is the important and delicate operation of removing the molds from the clay. The delicacy of the process comes in because the molds do not always "pull," that is, to get the molds off, it is necessary to break the clay and to destroy it; in one of the pictures the caster (who, in this case, is also the sculptor) is removing the back pieces of the lower mold of the heroic size statue. The coat tails have been broken off in the mold, and the clay composing them must be dug out by hand, and with streams of water. The picture also shows the destruction wrought in the arms of the statue, the molds of which ruined the clay in being taken off.



The finished plaster cast.

Fitting key joints together.

Plastering the molds.



The operation of loosening the molds.

The operation of taking off the molds.

When the various pieces of the plaster mold are all removed, they are cleaned thoroughly of all clay, washed out and finally anointed with a specially prepared grease which will prevent the plaster which forms the cast to be made, from sticking. They are then assembled in place, ready for casting. In so large a statue as forms the subject of these photographs, no attempt is made to cast the whole in one piece; the legs and half the trunk form one piece, the head and chest another, the two arms are cast separately and so on. In order that the several parts should fit one another accurately, the molds are fitted together as the casts are made, and "key joints" are constructed, the raised or "dowel" part of the key being formed on the first cast made while it is still in the mold (and is covered with grease) so that the second cast when made shall form its recess or female part of the joint, thus insuring an accurate fit. The pouring of the plaster for the final cast is also a delicate operation. The plaster must not be too thin, or it will run away from some parts of the mold and settle in other portions; it must not be too thick, or it will not run into all parts of the mold. The casting must proceed uninterruptedly for each set of molds, or it may not come out a homogeneous mass. Generally, the molds, bound together with rope and wire, are turned about as the plaster is run in, to be sure of getting an even and complete casting. The molds are not filled with plaster, as that would not only make the cast very heavy, but give it an excellent chance to split from strains incident to hardening. The walls of the plaster cast, like those of the mold, are from four to six inches or more thick, but a hollow space is always left in the trunk and legs and arms of such a statue, so that in drying there is plenty of room left for air

to penetrate and get to both sides of the cast. When the molds are all cast, and the whole has dried a sufficient time, comes the most delicate part of all—getting the molds off the cast. For these will not pull from the plaster cast any more than they did from the clay. In this case, however, it is not the cast but the molds which are broken in removing them, and now the significance of the colored layer in the mold becomes apparent. The caster, working away at his molds with mallet and chisel, is safe so long as only white chips fly, as soon as he gets to the colored layer, he goes most carefully, knowing that immediately beneath it lies the cast. The molds are taken off in many pieces and thrown away; their function finished, what remains is a plaster cast, exactly like the original clay, which may be shipped away to the bronze factory (as the clay could not be shipped) there to have molds made in many pieces into which the bronze is poured.

Large statues like the one illustrated take several days to cast both mold and plaster cast, and at almost any time, the labor of months of sculpturing may be ruined by careless work. Of course, molds are broken in making and statues in plaster are chipped. These accidents are not necessarily ruinous, as besides in either mold or finished cast can be repaired. But the destruction of the clay that the plaster mold may be made, the destruction of the mold that the plaster cast may emerge, like a butterfly from the cocoon, is a delicate operation, and one mistake in the caster's art or one slip of the chisel may mean, if not destruction, at least grave danger to the success of the whole. Hence it is that the craftsmanship of the caster takes for a while the place of the artist, and becomes as much a necessity to the production of the finished likeness as all the skill within his fingers.

A New Form of Underwater Attack

A Torpedo that Carries a Gun

By Robert G. Skerrett

WITH the exception of some ships now building or planned, the thousands of tons of armor plate carried upon modern fighting craft are designed exclusively to combat passively the attack of various types of gun-fired projectiles. Below the load-line, these vessels depend for security upon the surrounding water, so far as the attack of artillery is concerned. The torpedo has commonly in the past been considered so limited in its range and so uncertain in its performance that but little weight has been attached to it by the partisans of the gun. Battle ranges seemed logically to keep the torpedo in the background, except at night, when the speedy torpedo-boat counted upon getting near enough to launch its weapons with a more reasonable promise of getting home a hit. The naval constructor, accepting the torpedo at its potential value as seen by the majority of the fighting officers, simply limited his efforts to frabricating the under-body of his fighting craft so that the damaging effects of a chance blow from a torpedo should be confined to a restricted area. Hence the inner and the outer bottoms, and the water-tight, cellular divisioning of the intervening space. As a matter of fact, the naval constructor's work stood up under torpedo attack and performed its function remarkably well. It is a matter of record, that the general run of torpedoes fired during the Russo-Japanese war did far less damage than was expected of them, and a goodly number of vessels so struck were not sunk as was counted upon, but were able to get into port and be repaired.

There were ships lost to both belligerents by subaqueous attack, but the most conspicuous of these disasters were due to the violent blows of passive mines. Where the active torpedo had failed in its mission the anchored, floating mine filled the offensive gap. These mines carried larger explosive charges than the torpedoes then in service, and proved two things: First, that the naval constructor had planned well, and, second, that the automobile torpedo must needs be made a more powerful weapon if it were to fill the office intended for it.

In the Russian fleet at Port Arthur were several vessels that had been built by the French for the Russian Government. In addition to the usual compartmenting of the inter-bottom space, the French designers had reinforced the region most likely to be attacked by torpedoes by means of a caisson built of plating nearly two inches thick. The object of this caisson—assuming that the explosion of the torpedo should be sufficient to rend or rupture the plating of the inner and outer bottoms—was to provide more space in which the guncotton gases could expand and dissipate the most dangerous percentage of their remaining force. The ingenious theory of this style of construction was proved to be all that its originators claimed for it. The Russian ships so built were several times hit by Japanese mines, and, while grevlously wounded over wide areas of their under-bodies, yet the caissons remained substantially intact, and the vessels were able to return to harbor. The Russian and the Japanese battleships that were sunk by means of mines went to the bottom suddenly, because the force of the bursting mines was sufficient to detonate the neighboring magazines; but it is not believed that the vessels lost in this way had the protection of caissons immediately next to the double-bottom space.

The immediate result of the lessons taught by the Russo-Japanese war—so far as they concerned underwater attack—was a widespread realization that the automobile torpedo would need some radical modifications if it were to make good in the future. Apart from the desirability of greater speed and greater range, the most conspicuous need was the power of delivering a more damaging blow when once in contact with its target. To that end, the size of the weapon was progressively increased in order that it might carry a bigger bursting charge of guncotton in its warhead. This desideratum has been realized; but the bursting charge of the biggest of the present day automobile torpedoes is not as large as that of the mines which damaged the ships of both belligerents during that conflict.

As a matter of fact, the more recent dreadnoughts have the under-water protection of the caisson or its equivalent, and one can't help but ask, "How does the increased charge of the warhead meet the requirements of to-day?" In addition to this, armor is being added to the defense against torpedo attack, and this is placing the underwater weapon at a still further disadvantage. Its chances of spreading havoc deep enough to affect a ship's vitals are more remote relatively today than they were during the struggle between the Russians and the Japanese. It is manifest that there is a big gap in this line of attack which the Whitehead and its various kindred rivals cannot fill, and here it is that the genius of an American, Commander Cleland Davis, of the United States Navy, provides us with an answer and places the torpedo upon a new and a more formidable footing.

Commander Davis has blazed a new path in the art. He has abandoned the guncotton warhead, which has been the accepted instrument of destruction since the inception of the Whitehead, and has substituted a gun in its stead. If one will study carefully the photographs of either bursting submerged mines or exploding automobile torpedoes, the most impressive visual sign of the violence exerted will be found in the great volumes of water blown heavenward. The water has yielded more than the steel structure attacked, and the major part of the energy designed to wreck has spent itself uselessly in blowing hundreds of tons of water into the air. Commander Davis has sought to so concentrate the powers of assault in his torpedo that but little of its force should be dissipated in disturbing the surrounding water while the bulk of the energy of his weapon should remain unimpaired and centered in piercing the enemy's defenses and penetrating to the very vitals of the object of attack. Commander Davis does not discount in the slightest the truly remarkable developments which have taken place in the other departments of the automobile torpedo. Increased range, higher speed, and more precise functioning all help him toward his objective; but it is his invention which makes this underwater projectile a graver menace to the biggest and the best of fighting craft.

The Davis torpedo, recently tested in the waters of the Lower Chesapeake, carried an 8-inch gun capable of expelling an 8-inch projectile with a muzzle velocity of something like a thousand feet per second. Ordinarily, an 8-inch gun strong enough to fire a shell with this velocity would be far too big and too heavy to be placed within the permissible limits of a torpedo. We are speaking of a piece of ordinance to be fired in the open air. Now, the Davis gun, when fired, is surrounded by the sea, which, so to speak, reinforces the walls of the gun, but this is not all. The weapon is made of vanadium steel, which has a very high elastic limit, and this great strength on the part of the metal makes it possible to construct a gun of seemingly ridiculous lightness. This fact has made the new torpedo practicable.

The muzzle velocity of a thousand feet a second is quite enough to carry the projectile through a single plate of Krupp armor, something like four or five inches thick when virtually in contact with the muzzle of the gun—as would be the case with this torpedo. Now, ships are not protected under water with plating of these dimensions, and it would be a much easier task for the projectile to pass successively through a number of thinner plates even if their combined thickness were more than the limit set. The projectile fired from this new torpedo carries a bursting charge of high explosive of between 35 and 40 pounds. This charge is detonated by a delayed-action fuse, which is designed to meet the maximum requirements imposed by the best protected dreadnoughts built, building, or projected. Our illustration represents the Davis torpedo attacking a ship of the Danton type of the French navy; vessels that typify recent practice, and which have the protecting caisson that saved some of the ships of the Port Arthur fleet from sinking when they hit the Japanese mines planted outside of that port. In our picture we see the shell piercing the five opposing bulkheads of steel, passing through one of the coal bunkers, and bursting in a boiler room. We must leave to the imagination the dreadful aftermath of this attack and the destruction of a boiler charged with high-pressure steam. The same shell might have hit either farther aft or farther forward and bored its way right into a magazine or a shell room, the consequences of which would be even more appalling. The disturbed water has been occasioned by the escaping propulsive gases from the gun, which have served to tear a big rent in the outer plating of the bottom of the ship, and the liberated air from the torpedo's air flask. The surface disturbance is very modest compared with that which either a submarine mine or an automobile torpedo of the usual types would produce.

The diagram under the picture represents the Davis torpedo, and shows a longitudinal section through only that part where the gun is installed. When the weapon has been launched upon its sinister errand the little propeller at the upper side of the torpedo's nose revolves and releases the tripping rod, so that the torpedo can be discharged upon contact with its target. When the rod hits the obstruction it is driven backward and engages the trigger which first compresses a spring attached to the firing pin and then releases it so that the pin can strike the gun primer, thus setting off the propelling charge of powder which drives the shell out of the gun. As soon as the projectile hits the outside plating of a ship's bottom the fuse in the base of the shell begins to function, being set to explode the charge in the shell so many hundredths of a second after impact. During the recent tests in the Chesapeake, the projectile first pierced the target from side to side, passing through a couple of armored bulkheads en route, and then exploded in the water beyond. The second attack was against that side of the target which was further protected by a plate of three-inch steel. The shell exploded at the instant of impact, and did not pass into the target, but the structure was so damaged that it sunk shortly afterwards. The lesson of the second attack laid stress only upon the fact that the fuse was not properly timed, otherwise the shell would have entered the caisson and exploded inside, doing still more damage. This is merely a matter of refinement, and does not qualify the startling possibilities which the Davis gun-torpedo suggests. In the future, in order to safeguard ships against attack of this sort hundreds of tons more of armor must be placed upon every fighting craft, and this must add greatly to their displacement and their cost, or be provided at a sacrifice of other vital features.

The Fire Sprinkler—Plain Business Proposition

FIRE COMMISSIONER JOHNSON, of New York, says: "As a business proposition the most effective fire prevention appliances which the Fire Department can order installed mean dollars saved to the owner of the large factory or other place of business. I refer to automatic sprinklers. Fire prevention experts agree that automatic sprinklers, coupled with a device for sounding an alarm direct to fire headquarters, form the best known method for preventing destructive fires. Experience of many years shows that automatic sprinklers rarely fail to hold fire in check until the department apparatus arrives to put on the finishing touches." In two thirds of these cases the fire is completely put out by the time the department gets there.

Correspondence

[*The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.*]

A Typewriter Ribbon

To the Editor of the SCIENTIFIC AMERICAN:

Please allow me to suggest the following method of making typewriter ribbon.

The base of the ribbon is the so-called "seam binding," which may be obtained at any dry goods store. It is about one half inch in width, thin, and of fine texture. The white should be purchased.

Lamp-black is thoroughly incorporated with castor oil by grinding in a mortar. This is brought to the consistency of thin paint with alcohol. The ink is applied with a cloth or brush. Oil-soluble colors may be used instead of lamp-black.

Lincoln, Ill. C. C. KIPLINGER.

Gyroscopic Action in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

With all due deference to Mr. Jerwan's experiences (as related in Correspondence, April 20th) it seems rather peculiar that simply because a gyroscope is in an aeroplane it should defy the laws of nature.

The Blériot machine of which he speaks would naturally circle in whichever direction it is started, because the center of gravity is behind the wheels, so that the centrifugal force throws the tail out. It might be started in either direction in many ways, such as a side gust, untrue wheels, or a slight turn of the rudder. It might be started to the left (with right-hand propeller) by the drag of the torque loaded wheel or gyroscopic action *while the tail was rising*. The latter would be momentary, and after the tail had risen it would tend to make the machine travel straight rather than circle.

Toronto, Can. CANADIAN SUBSCRIBER

Politics and Good Roads

To the Editor of the SCIENTIFIC AMERICAN:

I have read with interest your article in the SCIENTIFIC AMERICAN of May 11th, 1912, on road conservation. During the last six years I have traveled over many miles of roads in nearly all the Eastern States, and have watched with a great deal of interest the great increase in road building.

It is a delight to travel over a new State road during the first year of its life. The second year the delight is considerably less. The third year you are tempted to take to the open fields, so terrible is the going.

By this time the road needs rebuilding in most cases, and this means a fat contract.

To me this has always been the explanation of why no attempt is ever made to preserve the roads.

The original contract usually goes to some favored politician. The sole scheme being to get all the profit or graft possible, the construction suffers. I know personally of one instance where an engineer insisted that a politician-contractor comply with the conditions of his contract, and was immediately transferred to another part of the State by a complacent State Department.

The quicker this road wears out, the quicker the politician gets another fat job, consequently no repairs are made. Road conservation is therefore a joke. A large part of the taxpayers' $50,000,000 goes to build up local political fences, and faulty roads which two or three years later require at least another $25,000,000 for rebuilding.

It all means prosperity to the politician-contractor.

Brooklyn, N. Y. H. GRATTAN.

[There can be no doubt that our correspondent's contention is correct. Not until road building and road maintenance are placed upon the same sound business basis that underlies every well-conducted industrial enterprise, is it likely that we shall have roads that are good, not simply for this year and perhaps next, but roads that will be good generations hence.—EDITOR.]

"The Digestion of a New-born Infant"

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of June 1st, on page 494, you have a short article under the above heading.

It is no recent discovery that new-born infants are capable of digesting food or that they possess digestive ferments. You mention of Dr. Alfred F. Hess that: "In the stomachs he found not only hydrochloric acid, as in an adult, but the two ferments pepsin and rennet." While it is true that milk requires almost no effort on the part of the digestive system, what little bit it does require is absolutely essential to the process. For instance, in all higher animals the first step in proteid digestion is accomplished by pepsin, a ferment which cannot act except in an acid medium. Hydrochloric being the kind of acid found in the stomachs of carnivora and omnivora. It is usually accompanied by small quantities of lactic acid. Rennin also is found of great importance in the digestion of milk. It is hardly correct to call it rennet, as rennet is a commercial preparation used in the manufacture of cheese, and is obtained from the stomachs of suckling calves and pigs usually.

The other ferments which you mention, namely, protease and lipase, are also necessary. The way in which lipase accomplishes the digestion of the butter fats in the milk is very interesting. To be brief, it splits them up into free fatty acids and glycerin, in which form they are capable of entering the villi. (Innumerable projections from the inner surface of the mucous membrane of the intestines, shaped like minute fingers, they are highly differentiated structures whose chief office is to absorb these digested glycerides.) Once within the villi, the synthesis of fatty acid and glycerin into fat becomes possible. Lipase is greatly aided by the bile in its work of digesting fat.

The hydrochloric acid in the stomach does not have any great effect on bacteria. In fact, none of the digestive juices possess bactericidal properties. Fortunately so, as so very rarely are bacteria harmful; the pathogenic kinds form such a small proportion of the whole.

It might not be out of the way to state that indigestion rarely occurs as a result of an insufficiency of digestive juices, but as a result of too concentrated foods; thus failing to distend the intestines, and so encourage peristalsis. Appropos of this, Dr. Charles E. Buck of Boston says "This condition never exists in the lower animals, who seldom suffer from intestinal troubles, because the food that they eat contains coarse particles of indigestible residue, that pass along the entire intestinal tract."

Oak Ridge, Va. A. G. INGHAM.

A Notable Lightning Stroke

To the Editor of the SCIENTIFIC AMERICAN:

On the afternoon of July 13th, a discharge of atmospheric electricity occurred in the village of Rockport, Ontario, which presented some features of unusual interest. About 6 P. M. a short and light thunder shower passed over the locality. The lightning seemed to be distant and the thunder was not loud. A single flash, however, struck a large white pine tree some seventy-five feet high, and tore the upper half into pieces, breaking off the branches, stripping the bark, and throwing one large fragment several hundred feet away into the St. Lawrence River.

From the tree the discharge apparently followed the telephone wire into a near-by house, smashing the windows, splintering the woodwork, breaking a 2-inch hole through a wire screen door (the broken wires showing traces of fusion) and, curiously enough, tearing off the metallic casters from a table. The telephone was connected with a ground wire which was attached to a window casing. This wire entirely disappeared, and only a groove in the wood was left.

Two ladies were standing near the telephone, one in the act of using it. Both received a severe shock and were temporarily stunned and benumbed, but recovered in a few hours without apparent injury. Owing to the nature of the soil and the long-continued drought, the ground connection was doubtless imperfect, which led to the damage to the house. Probably, however, it was the imperfect connection which saved the building from more serious injury.

In a building a few rods away a young man was holding a telephone receiver to his ear when the discharge occurred. He was thrown to the ground and received a severe nervous shock from which he did not recover for several days. This building was entirely uninjured, the telephone showed no marks of fire or any other injury, and none of the bystanders felt any shock.

The interesting points about this discharge were the sudden development of a large amount of electrical energy in a very light storm, and the almost total absence of marks of fire on any of the objects or persons struck. The splintering of the enormous pine tree could well be accounted for by the instantaneous development of steam from the sap in the wood, in connection with the expansion of the air in the tissues caused by the sudden heating by the current. The broken glass was thrown outward, indicating an expansion of the air in the rooms of the house.

One of the ladies struck said she felt no pain or shock, and remembered nothing except finding herself on the floor. The young man, however, felt a severe shock at the time, and the current probably passed from the receiver at his ear down the left side of his body, as that side and arm were benumbed for several hours. It was probable that this was an induced current in the telephone wire and not the direct discharge, as this telephone was connected with an entirely different circuit from the one first mentioned.

Rockport, Ontario. AUSTIN P. NICHOLS.

Magnetic and Electrostatic Attraction and Repulsion

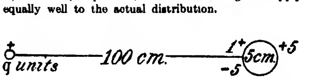
To the Editor of the SCIENTIFIC AMERICAN:

I was interested to read in your columns a short letter with reference to the force action between electric charges, and that between magnet poles, but do not exactly agree with the conclusions drawn by the writer, who apparently fails to take into consideration certain phenomena of induced electrification. In a certain sense it is true that under some conditions the question of repulsion or attraction of charged bodies depends upon the magnitudes of their charges, but only in an indirect manner, and the general law of the force action between charges still governs, even in the apparent exception noted.

To make the matter clear we might summarize the law of force action referred to. Briefly it is this Like charges repel one another and unlike charges attract one another with a force which is directly proportional to the product of the charges *and inversely proportional to the square of the distance between them.* This fact, together with the principles of induced electrification, explains the phenomenon noted by your contributor, namely, that if a body having a sufficiently great charge is brought near enough to another body having a charge of the same sign, attraction will result instead of repulsion, as we should expect.

When a charged body is placed in the neighborhood of another body (whether the latter be charged or uncharged) two induced charges of equal magnitude and of opposite sign are produced upon the latter, the one of like sign being the farther from the inducing charge. Since both charges are of the same magnitude, and the one of unlike sign the nearer, it follows from the law as to distances that the attraction between it and the inducing charge is always necessarily greater than the repulsion between the other charge and the inducing charge. Therefore a body originally uncharged is always attracted. If the body had originally a small charge of the same sign as the inducing charge, the body will be repelled if the distance between it and the induced charge is such that the difference in the distances of the two induced charges is small enough to make the difference between the forces on them less than the repulsion between the inducing charge and the charge originally on the body.

To make the matter concrete, suppose a body with a positive charge of q units placed at a distance of 100 centimeters from a sphere of 5 centimeters diameter, and having a positive charge of 1 unit localized at the end of the diameter nearest the first mentioned body. Suppose, further, that the induced charges are each 5 units similarly localized, one at each end of this diameter, as shown in diagram. Such a distribution is, of course, impossible, but the reasoning will apply equally well to the actual distribution.



We then have force action due to free charge of 1 unit $= 1 \times q/10{,}000$. That is repulsion $= q/10{,}000$ dynes. Similarly, the resultant force action (attraction) due to the induced charges is $5q/10{,}000 - 5q/11{,}025$ or about $5q/110{,}000$, approximately one half the repulsion. Therefore, the resultant is a repulsion. If the induced charges were to remain constant (they actually increase) as the charge q is brought up to the neighborhood of the sphere, say 5 centimeters from it, we should have Repulsion $= 1 \times q/25$ attraction $= 5q/25 - 5q/100$ Resultant $= 11q/100$ (attraction). This makes it evident that whether a physical object is attracted or repelled by a charged body is a matter of the relative distances of its charges from that body, the law as to the charges themselves still holding.

The conditions are very similar in the case of magnets. When a piece of magnetic material not manifesting poles is brought into the field of a strong magnet it develops poles, that of unlike sign being nearer the magnet pole which induced it. The laws of magnetic force action being precisely similar to those for electrostatic action, the same result follows as to attraction, namely, any unmagnetized bar of magnetic material is attracted. It may be laid down as a pretty safe rule, however, that like magnetic poles never attract one another. The polarity of a weak magnet may, however, often be reversed by bringing it into a strong field so quickly or in such a manner as to prevent its taking the position which the field of the stronger magnet demands. This has been a source of some annoyance in the case of compasses used in the laboratory by students who were careless in this respect.

To sum up definitely, it may be stated that the laws of force action always hold as between charges, or as between magnet poles. Apparent exceptions in the case of charged material bodies are due either to the characteristics of the bodies themselves or to the particular sets of magnetic or electrical constants involved. If not prevented by inertia, friction, or other means from doing so, these bodies behave in accordance with the laws as stated. M. F. THURSTON.

Syracuse, N. Y.

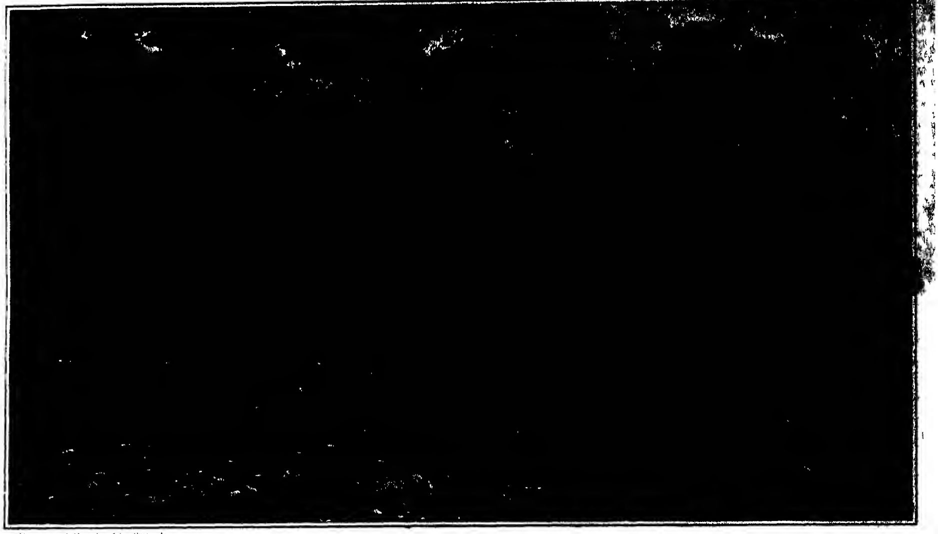


Photo by Valdeavellano & Co Guatemala

Fig 1 —Northeastern corner of Structure 1, showing the hieroglyphic cornice restored to its original position.

Quirigua—An American Town 1,400 Years Old

Glimpses of an Extinct American Civilization

By Sylvanus Griswold Morley, Acting Director Quirigua Expedition, School of American Archæology

DURING the months of February March and April the St Louis Archæological Society and the United Fruit Company maintained in the field at Quirigua Guatemala an archæological expedition the work being under the direction of the School of American Archæology

Quirigua was one of the older centers of the great Maya civilization which flourished in southern Mexico Guatemala and northern Honduras during the first fifteen centuries of the Christian era The writer believes that the occupation of this site lasted approximately from 450 to 550 A D though Maya students differ considerably on this point [1]

We have in the Western Hemisphere archæological relics of past civilizations as interesting scientifically as the ruins of Egypt Greece, and Rome Among them is Quirigua in Guatemala, some fifty miles from the Caribbean Sea Not until the present year was the systematic exploration of Quirigua begun This is the first popularly worded article on the results of the excavation that has thus far appeared The author writes from first hand knowledge inasmuch as he was a leading spirit in the work —EDITOR.

The work of the two previous seasons of the school at Quirigua 1910 and 1911 was largely of a preparatory nature In 1910 the ruins were surveyed and a reservation of 80 acres set aside which included all the more important remains The following year (1911) the dense vegetation which had overgrown the city since its abandonment in the sixth century A D was cleared away The importance of this step cannot be overestimated since the monuments were in constant danger of destruction from falling trees many of which exceeded 150 feet in height

The systematic excavation of Quirigua however was not commenced until the present year (1912) and it may be said at the outset that the finds already brought to light amply justify the continuation of the work The first place selected for excavation was the mound on the south side of the Temple Court A few preliminary trenches made at this point the year before had established the fact that this mound was the remains of a structure of very considerable importance Much sculptured stone was strewn around it on all sides and fragments of a hieroglyphic inscription including a date were recovered in the test diggings This seemed a most promising field for the inauguration of the work and a start was made here early in February From surface indications this mound appeared to be 105 feet long and 32 feet wide It rose from a platform or substructure the top of which itself was 20 feet above the general ground level

Before actual digging could commence it was first necessary to build a trestle to support a tramway by means of which the dirt could be removed A track was laid along each of the long sides of the building so that the work of clearing it could proceed from both sides at the same time As excavation proceeded, the ground plan of this once imposing structure, as well as its nature and use, gradually unfolded themselves.

It was symmetrical in ground plan and contained seven rooms. (See Fig 6, where a map of this building Structure 1 is shown) Entrance to these was gained by three wide doorways—10 feet wide each—in the north façade, which gave into chambers 2, 4 and 6, respectively The remaining rooms were entered from chambers 2 4 and 6, chamber 1 from chamber 2, chambers 3 and 5 from chamber 4, and chamber 7 from chamber 6. Three wide exterior doorways appear in Fig 2, which shows Structure 1 rising from the terrace at the back

These doorways were of great interest. The wall through which they pass is 8 feet in thickness, and the floors of chambers 2, 4 and 6 were in each case 2 feet higher than the floors of the doorways leading into them This 2 feet rise was effected by a single step, the front or face of which in each case presented a band of hieroglyphs. (See Fig 3, where the doorway leading into chamber 4 is shown) The band of hieroglyphics, against which the pick is leaning, is the top course of this 2 foot step, and, as appears in the figure, projects slightly beyond the courses below it Chamber 4, but partially excavated, appears in the background These three wide doorways with their hieroglyphic steps give to this building, even in its desolation, a rare touch of dignity

The floors of the interior rooms chambers 1, 3, 5, and 7 are 18 inches above the floors of chambers 2, 4, and 6, from which they are respectively entered

The rooms of this building average twelve feet in length, and are about half as wide. Although the ceilings have in every case fallen, their original height may be very clearly estimated at about 10 feet. Floors, walls and ceilings were covered with a hard, white lime plaster which still adheres in many places. No traces of wall paintings were found, though their absence may well have been due to the excessive rainfall—over 100 inches annually—to which this region is subjected, rather than to the failure of the ancients to have thus decorated their walls.

Along the back (south) wall of chambers 2, 4 and 6, there were low shelves, about 4 inches wide and a foot in height. (See Fig. 4, where chamber 2 is shown.) Note the shelf running across the back wall These shelves were covered with the same white lime plaster as the rest of the interiors In no case was any object found standing on them. In chamber 2, however, the fragments of a fine fluted bowl were found on the floor just against the back wall, and the bowl of which these were the parts probably stood on the shelf above, having been knocked off and broken when the roof fell in. Chambers 1, 3, 4, 6, and 7 yielded absolutely

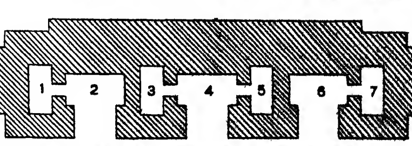


Fig 6.—Plan of Structure 1 with the chambers numbered.

[1] Various correlations of Maya and Christian chronology have been proposed from time to time Don Pio Perez Prof Eduard Seler Mr C P Bowditch and Mr J T Goodman each having advanced a different plan though most unfortunately no two of these agree The correlation proposed by the writer and his reason for adopting it will be found in Papers of the School of American Archæology No 11 Sylvanus Griswold Morley

[illegible] and chamber 2 only the fluted [illegible] been mentioned. Indeed, the only room in the entire structure which was at all rich in its yield of specimens was chamber 5, just off of chamber 4. This room contained two very fine flint spear points, as well as a dozen or more pieces of pottery.

In the back wall of chamber 4—the middle room of the building—at a height of 5½ feet above the floor, were tenoned the three stone heads shown in the bottom row of Fig. 5. When the roof of this room fell in, the tenons attaching these heads to the wall were broken, and the heads themselves fell to the floor, where they were uncovered during the excavation of the room. Two similar heads were found on the floor of chamber 6 and the broken butts of the tenons which had held them in the wall were still in position when this room was cleaned out.

When Structure 1 was completely excavated it became apparent that it had been a temple rather than a palace or dwelling type of structure. Several different facts pointed to this conclusion. In the first place, the location of the building, on a high terrace, which occupied one whole side of the Temple Court, indicated its importance, while the perfect symmetry of its ground plan—an almost universal characteristic of Maya temples[1]—strongly pointed to a building devoted to religious rather than to civil purposes.

Again, the fact that chamber 4, the middle room of the structure, was differentiated by its decoration from the other rooms—i. e., in having three heads tenoned into its back wall—seemed to mark it as the sanctuary proper, while the finding of a dozen or more bowls in an adjoining room, chamber 5, may well be explained on the ground that these vessels had been used in the temple service. The identification of this structure as a temple is further confirmed by certain of its architectural details. The only three entrances by means of which this building can be entered give into the only three rooms which have low shelves running across their back walls. These low shelves are admirably fitted both in character and position for the offering of sacrifices. Indeed, in chambers 4 and 6 it would seem as though the heads which were originally tenoned in their back walls may have represented the very deities to whom the sacrifices were offered. The width of the doorways giving into these three "shelf" or altar rooms is such—i. e., 10 feet—as to make the whole of their front sides open in each case, so that worshipers standing in the broad thresholds could easily see all that went on in the sanctuaries above and before them. The adjoining room or rooms with which each of these three sanctuaries is provided, afforded readily accessible places for the storage of ceremonial objects and religious paraphernalia, as well as convenient rooms in which officiating priests could clothe themselves. On the whole, the religious character of Structure 1 can hardly be doubted.

Before discussing the hieroglyphic inscriptions on the steps in the three above-mentioned doorways, it is first necessary to add a word concerning the exterior of this building. In common with almost all Maya structures the façade was divided into two halves by a medial cornice, which ran around the entire building about half way up the façade. In Structure 1 this medial cornice was composed of a band of hieroglyphics. (See Fig. 1, where the northeastern end of Structure 1 is shown with the hieroglyphic cornice restored to its original position.) The inscription began at the northeastern corner of the building, i. e., the corner shown in the above figure, and continued across the front and thence around to the starting point again. This cornice unfortunately was not in place at any point, but the writer was able to restore its first 18 hieroglyphics to their original positions, as appears in Fig 1.

So far as deciphered, this inscription records the date 9.19.0.0.0 9 Ahau 18 Mol of Maya chronology; that is the day 9 Ahau 18 Mol, the closing day of the nineteenth division or katun of cycle 9.

The katun was a Maya time period, which contained 7,200 days, and 20 katuns composed one cycle. We see here then, that when Structure 1 was dedicated, i. e., 9.19.0.0.0 9 Ahau 18 Mol, a cycle was very nearly at its close, since one more katun added to the 19 here recorded made 20 katuns or another cycle. This was indeed the case, for the next katun after the one here recorded ushered in cycle 10 of Maya chronology, i. e., the date 10.0.0.0.0 7 Ahau 18 Zip.

Passing now to a consideration of the texts in the three doorways; it will be found that the inscription in the eastern doorway opens with the date 9 Ahau 18 Xul. No record of the exact position of this date, that is its corresponding cycle or katun, etc., is recorded in this text, and to find its proper place in Maya chronology it is necessary to pass over to the inscription in the middle doorway. Here there are recorded 40 days, written in Maya notation as two periods of the second order, i. e., as two units, thus 2.0. Following this number occurs the date 9 Ahau 18 Mol, the same as appeared on the outside of the building in the hieroglyphic cornice on which there was declared to be the date, 9.19.0.0.0 9 Ahau 18 Mol of Maya chronology. It is a reasonable assumption, therefore, that the date 9 Ahau 18 Mol in the middle doorway was the same date as the date 9 Ahau 18 Mol outside, or 9.19.0.0.0 9 Ahau 18 Mol. Fortunately, this important point is not left open to conjecture; since in the text in the western doorway the end of katun 19 is explicitly recorded. Moreover, having established the position of this latter date, the date 9 Ahau 18 Xul in the eastern doorway may be reckoned from it, by means of the 40 days which are declared to have elapsed between the two.

The dates on Structure 1, therefore, may be summarized as follows:

Step in Eastern Doorway . .	(9.18.19.16.0)[3]	9 Ahau 18 Xul.
Step in Middle Doorway . .	2.0[4]	
	(9.19.0.0.0)	9 Ahau 18 Mol.
Step in Western Doorway	End of Katun 19	
Hieroglyphic Cornice .	9.19.0.0.0	9 Ahau 18 Mol

Although the greater part of this inscription yet remains an enigma, the chronological part as given above, may be accepted as final. Indeed, we may go a step further and analyze this part of the text somewhat as follows: Some important event occurred 40 days before the close of katun 19, at which time, and to commemorate which, Structure 1 was erected. This earlier and less important date was engraved on the step in the eastern doorway, and the distance from it to the really important date concerned here, i. e., 9 Ahau 18 Mol, the close of katun 19, was recorded in the middle doorway. In the middle and western doorways this important date is actually recorded, and it is again repeated in the most conspicuous place about this building, that is in the hieroglyphic cornice which ran around the outside.

The particular significance of this date

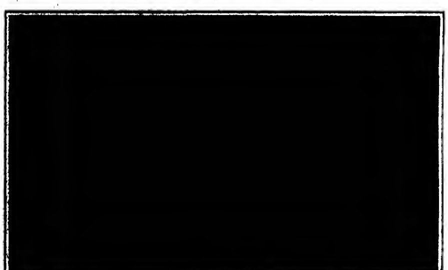
(Continued on page 105.)

Photograph by Goodle, Jr.

Fig. 2.—Structure 1 rising from terrace at the back, with Structure 2 in the foreground at the right.

Photograph by School of American Archaeology

Fig. 3.—Doorway leading into chamber 4, which is partially excavated.



Photograph by School of American Archaeology.

Fig. 4.—Chamber 2 completely excavated, showing shelf across the back wall.

Photograph by School of American Archaeology.

Fig. 5.—Group of stone heads found during the excavation of Structure 1.

[1] Throughout the Maya area, symmetry in the ground plans of temple type structures is the almost invariable rule. While it is true that this symmetry of ground plan was very largely extended to dwelling type structures as well, in this latter class, however, asymmetrical ground plans are more frequent than symmetrical. Asymmetry in the ground plan of temple type structures, on the contrary, is comparatively rare, and consequently symmetry in ground plan is at least a presumptive indication that structures having it were devoted to religious uses.

[3] Matter inclosed in parentheses does not appear in the text but is indicated by the accompanying dates.

[4] In Maya numeration only 18 units of the 2d order are required to make 1 unit of the 3d order. Elsewhere however, in the 1st, 3d and 4th places, 20 units are required to make 1 unit of the order next higher.

The Heavens in August

Proper Motions and Stars; Changing Constellations; The Planets

By Henry Norris Russell, Ph.D.

As we gaze upon the familiar figures of the constellations, the thought may well impress us deeply that these same groups of stars, practically unaltered in position and brightness, showed themselves to the eyes of the builders of the Pyramids. From the standpoint of recorded history, the starry heavens are the fixed and unvarying canopy which roofs in the changing peoples and empires of earth

But will this be true if we expand our range of thought to the scale of geological time, or even to that lesser extent which embraces the probable duration of human existence upon our planet? Suppose we might leap in an instant over a hundred thousand years, and look once more at the skies Would we find then our familiar constellations? Which, if any, among them would still bear a recognizable resemblance to their present aspect?

Bold as the questions may seem to be, modern astronomy is ready with the answer. The positions of the stars have been observed for the past century with high exactness, and their motions calculated with such precision that they may be predicted (in general) for even one hundred thousand years in advance with as great accuracy as they could be plotted by the most careful eye-estimates or laid down on any star-map of ordinary size.

The accompanying illustration shows the results of such a study of the brighter stars of the constellations Scorpius and Sagittarius, which are now so conspicuous in the southern sky. The outline of Scorpius, on the right, and the "Milk Dipper" in Sagittarius on the left, can at once be recognized. The arrow attached to each star shows the direction and amount of its apparent motion in one hundred thousand years

Before this period is concluded, it is evident that the Milk Dipper will have lost all traces of its present shape, and that the whole constellation of Sagittarius will be quite unrecognizable This is what we would find in most other constellations.

Scorpius affords a very interesting exception to this general rule A few of its stars—notably Epsilon Scorpii, near the middle of the constellation—are moving at a relatively rapid rate, which will carry them almost out of the region now regarded as belonging to the Scorpion One or two at the extreme southwestern extremity are moving so slowly that they will be almost in their present places a hundred thousand years hence But the majority of the stars show a very conspicuous tendency to *keep* together in their motion. The eight bright stars in the upper part (including Antares) will be in almost exactly the same relative configuration then as now, though about a degree farther south Both components of the naked-eye double μ (shown as a single star on the diagram, next below the rapidly moving ϵ) and the conspicuous stars λ and ν at the tip of the tail, evidently share in the motion of this group, as does Theta Ophiuchi, farther to the north, and also a number of fainter stars, not shown in our figure

So many of the stars of the constellation are involved in this common "drift," that the figure of the Scorpion will still be recognizable, even after the other stars which are at present counted as belonging to it have moved clear away into other constellations, and the "head" at least should be recognizable even half a million years hence Hardly any other constellation will last as long, excepting Orion, all whose principal stars are moving even more slowly than those of Scorpius.

Such a remarkable community of motion among the stars of a well-defined region cannot possibly be the

Proper motions of stars in Scorpius and Sagittarius in one hundred thousand years.

result of chance. It requires only a glance at the diagram to convince anyone that they form a real cluster, are relatively near one another (compared with their distance from us), and are moving together in the same direction. This is in fact the most conspicuous example in the heavens of the "moving clusters" of stars, of which so much has recently been heard in the astronomical world, and its nature has been pointed out independently by several astronomers—Prof. Kapteyn, Mr. Eddington of Greenwich, and Mr. Benjamin Boss of Albany. This is not all. It is perceptible, even on the diagram, and evident from an exact study of the stars' motions, that the easternmost stars of the cluster appear to move in a direction decidedly to the east of south, while the westernmost are going almost due south. The obvious explanation is that the cluster is approaching us, and hence appearing to grow larger and spread out. This is confirmed by the spectroscopic measurements of the radial velocity of many of these stars, which (after applying certain corrections, the need for which has been shown by Prof. Campbell) show that they are all approaching one system slowly, at an average rate of about four miles per second.

This, as well as the other facts regarding this cluster, can be explained on the assumption that the stars composing it are practically at rest in space, and that their apparent motions are really due to the sun's motion. This makes it possible to calculate the distance of the group, which comes out rather more than three hundred light-years. At this distance the sun would be utterly invisible to the naked eye—fainter, in fact, than the ninth magnitude. The conspicuous stars of the cluster must, therefore, be of great brightness. All those shown on the diagram exceed two hundred times the brightness of the sun, while most of them must give out fully five hundred times, and Antares not less than two thousand times, as much light as the ruler of our system.

The Heavens.

Our map shows the aspect of the evening sky, and requires little explanation. Scorpius and Sagittarius, of which we have been speaking, are conspicuous in the south and southwest. Above them is Ophiuchus, then Aquila, with Cygnus and Lyra overhead. Hercules, Corona, and Boötes are in the west, Draco and Ursa Major in the northwest, and Perseus and Cassiopeia in the northeast. Aries, Pisces, and a part of Cetus are on the eastern horizon, with Andromeda and Pegasus above them. Aquarius, Capricornus, and the Southern Fish in the southeast complete our survey.

The Planets.

Mercury is evening star until the 22d, and morning star after that date, but is not very well placed for observation even at the beginning of the month. At this time he sets a little after 8 P. M. and may be seen in the twilight, but by the 10th he gets too close to the sun, and too far south, to be easily seen, and remains invisible through the month.

Venus is theoretically an evening star once more, and may perhaps be seen in the latter part of the month (though she sets but a little after 7 P. M.) because of her great brightness.

Mars is still an evening star, in Leo, setting about 8 P. M. in the middle of the month, and too low in the west at dark to be easily seen.

Jupiter is in Scorpio, and comes into quadrature with the sun on the 30th. He is a splendid object in the evening sky, but sets before midnight. Saturn is on the opposite side of the heavens, in Taurus. He is in quadrature on the 27th, and rises a little before 11 P. M.

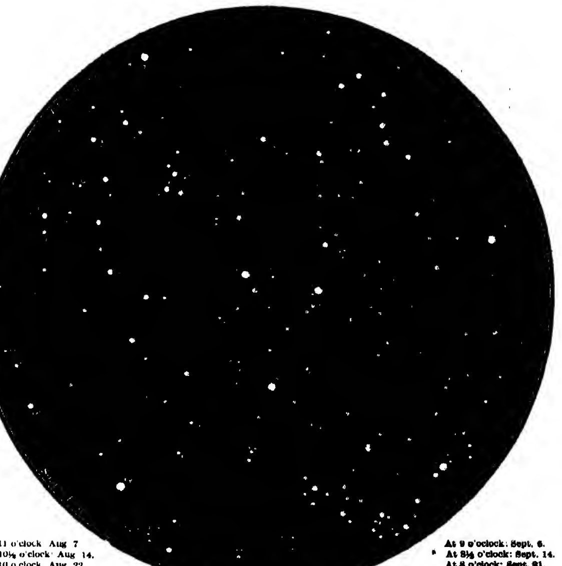
Uranus is in Capricornus, and crosses the meridian about 10 P. M. in the middle of the month. He may readily be found with the aid of the maps published in previous issues.

Neptune is in Gemini, rising about 1 A. M.

The moon is in her last quarter at 10 P. M. on August 5th, new at 2 P. M. on the 12th, in her first quarter at 11 A. M. on the 19th, and full at 2 P. M. on the 27th. She is nearest the earth on the 12th (high tides again expected) and farthest away on the 25th.

She is in conjunction with Jupiter on the 7th, Neptune on the 10th, Venus and Mercury on the 13th, Mars on the 14th, Jupiter on the 20th, and Uranus on the 24th; none of the observable approaches being close.

Princeton Observatory.



At 11 o'clock Aug 7
At 10½ o'clock Aug 14.
At 10 o'clock Aug 22

At 9 o'clock: Sept. 6.
At 8½ o'clock: Sept. 14.
At 8 o'clock: Sept. 21.

At 9½ o'clock: August 29.

NIGHT SKY: AUGUST AND SEPTEMBER

The Business Aspect of Synthetic Rubber

What are the Prospects of the New Discovery?

By Prof. Dr. F. W. Hinrichsen, of the Koenigliches Material-Pruefungsamt

The author of this article recently completed for the Koenigliches Material-Pruefungsamt at Lichterfelde a very elaborate investigation of rubber. No man is better qualified than he to discuss the technical and commercial significance of the discovery of synthetic rubber made by Prof. Perkin. While the Editor does not wish either to detract from Prof. Hinrichsen's argument or to assist the stock-selling transactions of the English company formed to exploit the new discovery, it seems only fair to point out that in the prospectus of the English company it is clearly set forth that the immediate purpose is to manufacture fusel oil and acetone, and that part of the proceeds assured in this way are to be devoted to research on a factory scale upon the new rubber process.—EDITOR.

AT the great jubilee meeting of the Society of German Chemists, which took place at Freiburg im Breisgau last Whitsuntide, the attention of the general public was drawn to the question of the synthetic production of India rubber, two workers of special prominence in this field, Prof. C. Harries, of Kiel, and Dr. F. Hofmann, of Elberfeld, giving a comprehensive report, from the scientific and technical standpoint, on the present status of the problem.

Only recently Prof. Perkin, in England, has read a paper on the same subject, and has given publicity to new results of research in this field. While, however, the two German investigators mentioned above were very guarded and skeptical in their expressions relating to the future of synthetic caoutchouc, and regarded the time when synthetic rubber will appear upon the market as still far off, the lecture of the English chemist was more optimistic. The result was that a company with $2,500,000 was immediately founded, which counts among its board of directors no less a chemical authority than Sir William Ramsay, while Sir William Tilden has been retained as consulting chemist. Nevertheless, the opening of the list for subscriptions for shares, so far as we can judge from report, seems to have been a comparative failure, only a very small amount of capital having been sunk in the new foundation. The conservatism displayed in this case by the English public would seem to be entirely justified, for, upon critical examination, it is found that even the new results communicated by Prof. Perkin do not by any means justify the hope that any considerable quantities of synthetic caoutchouc will be produced in the near future.

From the scientific standpoint, the question of caoutchouc synthesis is clear at the present time. It is well known that caoutchouc is formed from isoprene, a compound of carbon and hydrogen, obtained as a mobile, colorless liquid of low boiling point (35 deg. Cent.), for example on heating caoutchouc itself or turpentine. As was first shown by Hofmann, rubber-like bodies are also obtainable from other compounds of carbon and hydrogen besides isoprene, which, however, must have a somewhat similar chemical constitution. Among them may be mentioned the hydrocarbon butadiene. The transformation of such compounds into caoutchouc can be effected either by simply heating under pressure with or without the addition of other substances (Hofmann) or by the influence of small quantities of metallic sodium (Harries); the products obtained differ entirely in their properties, according to the nature of the initial material employed and the conditions of transformation.

In order that synthetic rubber may be capable of competing successfully with the natural product, it must be equal to it in technical use and must be at least as cheap to manufacture.

As regards the first question, there can hardly be any doubt that in the course of time it will be possible to produce rubber by artificial means which will be equal or even superior to natural rubber in technical use. We have not, however, as yet arrived at this stage.

The price of synthetic rubber, on the other hand, depends, in the first place, on the cost of production of the initial material, isoprene, and allied hydrocarbons. Here also it can hardly be doubted that before very long processes will be found which will yield these substances more cheaply than methods known hitherto. At the present time, however, there is no such method known for isoprene, the parent substance of natural rubber. The problem is rendered particularly difficult through the fact that the substances employed must be specially pure. Most of the processes proposed hitherto do not yield a pure isoprene, but mixtures of different hydrocarbons of similar constitution. Hofmann himself, in the preparation of pure isoprene, starts from a constituent of coal tar, namely, cresol; but in this process also, so far as can be judged at the present, the cost of production is considerably greater than for natural rubber.

But even if it should be possible to prepare sufficient quantities of isoprene at a sufficiently low cost, the difficulties of the problem, as Hofmann has pointed out, only begin, for the yields are comparatively small in all methods of this kind. Consequently, in technical production on a large scale, such as is implied in case serious competition with the natural product should be contemplated, such enormous quantities of by-products are obtained, that their disposal or utilization would probably present a more difficult problem from the economical and technical point of view than manufacture of the caoutchouc itself. How is it in this regard with the new process communicated by Prof. Hofmann, and so hastily made the basis of financial operations? The principle of the new method of producing synthetic caoutchouc depends, on the one hand, on the cheap production of hydrocarbons which can be used as initial materials for rubber; on the other hand, on the acceleration of the conversion of these hydrocarbons into rubber-like substances. Prof. Fernbach, of the Pasteur Institute in Paris, has shown that starch (obtained from potatoes or maize) can be converted by means of yeast-like ferments into a mixture of fusel oil and acetone. From these compounds, the hydrocarbons required as raw material for the caoutchouc can be produced by suitable chemical transformation. The transformation of these substances into rubber-like bodies is effected by means of metallic sodium; that is to say, by the same means as discovered and used independently by Harries. According to Perkin's communication, this method was discovered and made the subject of patent application by Matthews half a year before Harries, though no publication was made of the fact. It must, therefore, be admitted that the priority of invention belongs to Matthews.

The use of starch as the initial material is alluring at first sight, owing to its low price. When, however, we examine the new process a little more closely, we cannot quite suppress doubts as to its financial soundness. An inquiry addressed to the highly reputed *India Rubber Journal* of London, regarding yields obtained in the several stages of the process, brought the following information. By Fernbach's process there is obtained from starch 42 per cent to 48 per cent crude fusel oil. The starch content of potatoes or maize is about 60 per cent. The "fusel oil" itself is said to contain only about two-thirds of true fusel oil, the rest being acetone and other compounds. Furthermore, the fusel oil gives a yield of 40 per cent to 50 per cent of isoprene, which latter is converted without loss into rubber. According to calculations which the above-mentioned English technical journal made, 100 tons of starch will be required for the production of 1 ton of synthetic caoutchouc in this way. From this it follows that only about 1 per cent yield, figured on the starch, is finally obtained, while 99 per cent of the latter goes into by-products. For the production of a quantity of synthetic rubber corresponding to the present world's consumption (about 74,000 tons), such an immense surface would have to be planted with potatoes that the ground now occupied by rubber plantations would represent only a small fraction of this.

That such a process as this cannot be very practicable is obvious. Added to this is the fact that the proof is still owing that the material obtained by the English process fulfills the technical conditions.

As has been shown by Harries, artificial rubbers obtained by means of metallic sodium differ chemically from natural rubber. It is, therefore, not by any means probable, *à priori*, that the new products will be found equal in their mechanical and physical properties to natural rubber. The situation is rendered still more difficult through the fact that the chief constituent of the product obtained by Fernbach's process is so-called butyl alcohol, which, on further treatment, does not yield isoprene, the parent substance of natural caoutchouc, but butadiene, which has already been referred to. We may, therefore, expect that the English process will yield substances differing materially in their properties from natural rubber. In any case, their technical usefulness and value is still awaiting proof. On this point there is practically no evidence available. The invention is still in the laboratory stage. As we read in the *India Rubber Journal*, there have hitherto not been prepared more than one or two pounds of synthetic rubber by the newly described process.

There is, therefore, no doubt that the formation of the company is premature. Synthetic rubber will certainly come, and will claim its place upon the world's market, not suddenly, however, at one blow, but gradually. Even then it is not probable that it will ever completely displace the natural product, especially the plantation rubber. It is much more likely that some sort of equilibrium will be struck, similar to that which now exists with regard to artificial and natural silk. In the field of technical progress, the law of inertia rules as in other domains.

The Increasing Temperature of the World

A PROPHECY of what is claimed by many to be the increasing temperature of the earth and an explanation of the recent prevalence of hot summers is found in a volume written by C. R. Van Hise, president of the University of Wisconsin, and published in 1904 by the United States Geological Survey. In this book (A Treatise on Metamorphism) Prof. Van Hise pointed out that the enormous burning of coal by man must steadily vitiate the air by the discharge of carbon dioxide, and that this vitiation must bring about a marked increase in the temperature of the globe. He says (pages 455-465):

In 1899 the amount of coal mined and oxidized amounted to 728,367,454 metric tons. At the beginning of the last decade of the nineteenth century, 1890, the production was only 511,518,358 metric tons. This shows how rapid the increase in the use of coal has been, and therefore a combustion of 1,000,000,000 metric tons a year is probably very conservative as the estimated average for the present century. Taking 1,000,000,000 metric tons as the amount of coal oxidized per annum for the future, and supposing the amount of carbon in this coal to average 80 per cent, the quantity of carbon which passes into the atmosphere would be 2,933,333,000 metric tons per annum. This is 0.1233 per cent of the total amount of carbon at present in the atmosphere. If this rate of consumption of coal were continued 812 years the amount of carbon in the atmosphere would be doubled.

"It therefore appears probable that within a comparatively short time in the future, as compared with a single geological period, or even an epoch, the amount of carbon in one of its great reservoirs, the atmosphere, will be increased to an important extent. From this fact, various geological consequences are likely to follow. One of the most important of these is a higher average temperature for the globe. According to Arrhenius, if the carbon dioxide is increased 2.5 to 3 times its present value, the temperature in the Arctic regions must rise 8 deg. to 9 deg. Cent. (14 deg. to 15 deg. Fahr.) and produce a climate as mild as that of the Eocene period. According to the above computation, the carbon would be increased by the oxidation of coal alone to three times its present amount in one thousand six hundred and twenty-four years.

"A further consequence which would follow from an increase in the amount of carbon in the atmosphere and the warmer climate would be a much more abundant and widespread vegetation, and more vegetation means that when oxidized more carbon dioxide will be concentrated in the soil, and this concentration will lead to an acceleration in the rate of carbonation. Furthermore, the increase in average temperature of the globe will accelerate all other chemical reactions of the belt of weathering. It therefore appears probable that the artificial oxidation of coal will result in some of the most profound and far-reaching geological consequences which are due to the agency of man."

Since this was written the world's annual consumption of coal has about doubled, so that six thousand million tons of carbonic oxide are now being annually discharged into the atmosphere. In view of this fact, there is little wonder that Prof. Van Hise's prognostications in regard to the increased temperature should have been so swiftly verified

Curiosities of Science and Invention

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.

A Land and Water Cycle

A RESIDENT of Oakland, California, owns a contrivance of his own making which it is claimed will convey him over land at a rate of twenty miles per hour and on water at the rate of fifteen miles an hour. The device he calls a hydro-motorcycle. It consists of a motorcycle equipped with two canoe-shaped metal floats, each fourteen feet long and about sixteen inches wide. Each canoe is divided into three airtight compartments and is fastened on a light steel tube frame. When traveling over land, the floats are evenly balanced, as they are carried one on each side of the motorcycle. When it is desired to make a water craft of the motorcycle, the two floats are simply reversed on their hinges and clamped down by a simple device. The propeller which, when not in use, is carried behind the seat may be dropped down into the water to propel the craft. The propeller drive contains a clutch which connects the power with a 3-foot propeller shaft of ¾-inch steel. The propeller has three 12-inch blades. Steering is effected by means of two small rudders, one on each of the floats, and both connected to the handlebar of the motorcycle. The total weight of this amphibious vehicle is 425 pounds, of which 225 pounds represents the weight of the attachment.

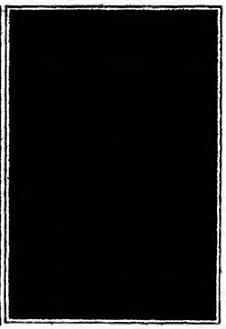
The floats folded up for land travel.

A spin on the water.

Amateur's Star Finder

AN astronomical instrument of great precision and remarkable simplicity, enabling any layman to ascertain the names of stars of constellations observed in the skies, and inversely find any star whose name or position has been given, has been designed by F. Sartorius of Göttingen. The star finder consists of a star map which may be adjusted to the geographical latitude of the place, and, a diopter pointed toward the star to be determined. Actually the device consists of an equatorial mounting, similar to that of a telescope. The main stand is a tripod provided with a spirit level for adjusting the head to horizontal position. The stand carries a graduated arc for setting the axis of the star map to the proper angle of inclination. It will be understood, of course, that the axis must be parallel to that of the earth, so that it will point to the North Pole of the heavens. The angle of inclination, therefore, is that of the latitude of the place. For instance, the latitude of New York is about 41 degrees north, consequently the axis would have to incline 41 degrees from the horizontal. A compass is provided for setting the axis in the north and south plane. The star map, then, will lie in the plane of the celestial equator. Mounted to rotate over the surface of the star map are two arms which cross each other at right angles. At the end of one of these arms the diopter is mounted, so that it may be rotated in a plane at right angles to that of the equator. The star map is provided along the circumference with graduations which indicate the right ascension of a star, also with a scale which shows the daily and monthly displacement of the heavens to be accounted for. In using the apparatus the hourly advance should also be followed continually. The diopter is swung bodily about the star map, until the arm that lies at right angles to its axis comes in contact with the star on the map whose position in the heavens it is desired to find. Then the diopter is swung to the proper angle of declination of the star as indicated by the graduations on the arm, when, on looking through the diopter, the star will fall within the field of observation. This instrument will doubtless be welcomed as an excellent means of getting an insight.

An instrument for locating and identifying stars.



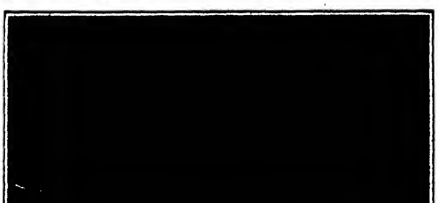
Apparatus for scaring sheep together and wolves away.

Who Owns Spitzbergen?

THIS question is often asked nowadays, in view of the remarkable development of these Arctic islands. A conference to settle the question has just been held between the governments of Russia, Sweden and Norway. A convention has been drawn up, in accordance with which Spitzbergen will be a neutral territory, open to all nations, but governed by a joint board consisting of one representative of each of the three powers above named. Taxes will be levied by the board, subject to the approval of the respective governments.

A Sheep Protector

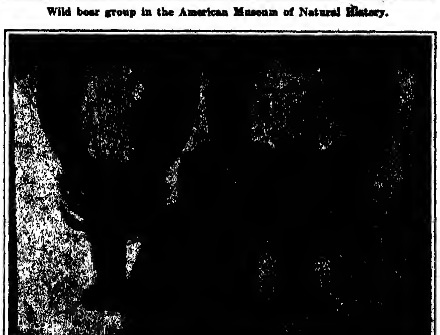
AN invention to protect sheep from the inroads of wolves, coyotes and other animals that prey upon the herds has been devised by E. C. Winchester of Thermopolis, Wyoming, and has been pronounced by sheep men of that region to be the most practical device for scaring away wild animals and keeping the sheep together at night that has yet been offered. The machine consists of an automatic gun which will shoot a blank cartridge every 30, 40 or 60 minutes, as arranged, while a bull's eye lantern is so adjusted as to revolve and flash its light in every direction. It makes more than one revolution a minute, operating by means of a coiled spring and cog-wheels, a sort of clockwork, in fact. The mechanism is inclosed in a storm and dust-proof metal case and mounted on four adjustable legs. It has a weight of 25 pounds, so that it can be carried with the sheepman's outfit with no difficulty.



Wild boar group in the American Museum of Natural History.

Wild Boar Group in Realistic Surroundings

A NOTEWORTHY wild boar group, the first of its kind to be seen in this country, has recently been placed on exhibition at the Museum of Natural History, New York. A colony of nine animals, old and young, have been realistically grouped so as to represent a habitat scene in winter in the forests of Germany, with a painted background of mountains. The group measures 9 by 15 feet. The series of fine boar skins was presented to the museum by Mr. Walter Winans, who is a noted sportsman, hunter, and horseman. The right foreground is occupied by two of the largest male boars, depicted in a fierce battle, a number of young ones are seen lying on the ground, while other still larger ones are standing in the near distance, watching the outcome of the combat. The spirited and lifelike modeling of the animals and the mounting was executed by Mr. Frederick Blaschke, the animal sculptor of the museum. The group is considered to be one of the finest and most up-to-date examples of the new plastic taxidermy.



Sixty-two pound lobster catch off the Highlands of New Jersey.

Two Record-holding Lobsters

TWO lobsters that are claimed to hold the world's record for size have just been mounted and placed on exhibition in the Museum of Natural History, New York. The larger specimen, the one on the right, weighed, when alive, 34 pounds and was nearly three feet long; the other one weighed 28 pounds. Both of these monster lobsters were caught off the Highlands of New Jersey, where they are said to have played havoc with the lobster traps, cutting holes in them and robbing them of all the bait, as their bodies were too large to get inside. Finally they were hauled up to the surface clinging to a trap. The larger specimen showed many scars, evidently from savage combats. The length of its life is estimated to have been fifty years as the average age of a ten or twelve-inch lobster is thirty years. The sea is a very poor nursery, and the best authorities figure the rate of survival in the lobster as about 2 in 30,000 eggs. Owing to over-fishing and illegal destruction of the egg-bearing females, etc., large lobsters are fast disappearing. Out of a catch of 1,000 in a recent Government experiment in New England, only 25 were found to be 13 and 14 inches long. Their ultimate extinction in the near future, it is thought by fishery experts, can be prevented, only by artificial propagation, which has been so successfully demonstrated at the Rhode Island hatchery at Wickford.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Gaging the Cultivated Blueberry

WHILE the New England blueberry is justly famous, its systematic cultivation, until recently, has been neglected, largely through the belief that it was impossible.

The large bushes in the grounds of the Smithsonian Institution at Washington are probably more than fifty years old, and many such bushes in the Arnold Arboretum near Boston demonstrate the fallacy of the idea that the blueberry cannot be transplanted and cultivated.

Some years ago Dr. Frederick D. Coville, botanist in charge of Taxonomic and Range Investigations of the Department of Agriculture, started upon a series of investigations of the culture of the berries, which has continued to the present time with somewhat remarkable results. Proceeding with the idea that previous failures along the same line had been due to a misunderstanding of the soil requirements of the blueberry, which are radically different from those of our common cultivated plants, the Doctor, whose interest in the subject was attracted as far back as 1906, has made a careful study of the soil requirements with important results. It is evident from a consideration of what he has accomplished, as fully set out in a bulletin of the Bureau of Plant Industry of the Department of Agriculture, that the problem has been practically solved. As each advance in the arts and sciences creates a new condition or conditions, and these make demands upon the creative faculties, the Doctor found it necessary to devise a gage. This huckleberryometer, or blueberry gage, as it is more prosaically known in the department, is used for measuring the berries and in noting the progress of the cultivation. The possibility of culture has not only been demonstrated but the size development as well. Starting with a normal size of the opening No. 11 of the gage, the berries have been developed to size No. 15 and doubtless a further cultivation will result in a much larger size, the flavor and fruitiness of the berry being improved, rather than impaired, by the cultivation.

Some Interesting Toys

TOYS, especially toys in the form of dolls, are interesting to most people, and we sometimes find a toy that combines the utilitarian with the amusing. Thus Mary L. Rusk of New York city has patented a water bottle, No. 1,026,460, in which is combined a hot water bag and a cover in the form of a doll, the dress of the doll extending over the hot water bottle. By this construction, as the patentee expresses it, there is provided a hot fluid container which by reason of its appearance will be attractive to a child so that a child will permit it to be placed near it. Thus the child in taking the doll to bed with it will also have a bed warmer at the same time.

J. G. Hanley of London, England, has patented, No. 1,028,068, a toy which is shown in the resemblance of an ape and it is formed of a bag of felt, cloth or other suitable material and the lips or jaws are flexible, so that they may be manipulated by the hand to produce a grotesque and realistic effect.

Another toy has been patented, No. 1,025,909, to F. W. Fiegel. It includes a stationary picture card which has an opening in it and within the opening is arranged a contortive diaphragm which may be of sheet rubber and contains a portion of a figure such as the back and shoulders of a man, while the complementary arm portions of the figure are upon the stationary card, so that the contortive portion in the opening of the fixed card can be manipulated to produce an effect similar to that of working the muscles of the back.

A Tablet Sorting, Counting and Filling Machine

By the English Correspondent of the Scientific American

THE increasing popularity of medicinal preparations in a compressed tablet form has resulted in the evolution of an ingenious apparatus for sorting, counting and packing these preparations, which is shown in the accompanying illustration. The machine is the invention of Mr. Eduard Naumann, of Göthen, Anhalt, Germany, and has been in operation in one of the largest Berlin manufactories for several months past with complete success. The tablets are poured into a trough-like hopper, which is fitted with a specially constructed roller for the purpose of cutting off the supply and which permits a certain number of the pellets to be carried on to an agitator which sifts off the adhesive powder. The tablets are then carried forward automatically on to a grid where the imperfect tabloids are rejected.

Medical tablet sorting, sifting, counting and filling machine.

The pellets are now moved forward to the counting mechanism where, by means of a peculiar movement, the required number to enter the bottle or box are counted off and emptied into the receptacle. The counting device can be altered so that any number of pellets as desired may be passed into the vessel. A short pause is then made to allow the charged bottle to be removed, and an empty receptacle substituted at the mouth of the machine.

The apparatus can be worked either by motor power or by hand. It has been found to be thoroughly reliable, exact, and efficient. In a working day of seven hours some 200,000 tablets can be sorted, sifted, counted, and charged into boxes or bottles.

Firing Submarine Mines by Wireless Telegraphy

DR. BRANLY, the well-known French scientist, has been engaged for some time past upon various kinds of wireless distant control apparatus. He has already devised some very successful instruments for steering torpedoes, firing submarine mines, lighting lamps and carrying out a large number of operations from a distant post by sending out suitable wave signals as in wireless telegraphy. More recently he has brought out the apparatus which we illustrate here, and it is intended to protect the distant control devices against the action of continuous streams of sparks such as the enemy might send out in time of war. Not only does it prevent the continuous sparks from having any action upon the apparatus, in the case of firing a submarine mine, for instance, but should the sparks cease even for a short time, the home operator can now send out a special signal which will fire the mine. The enemy, on the other hand, will be powerless to carry out any operation of the kind. Dr. Branly's protecting device consists of a horizontal disk moved by clockwork and is kept constantly in rotation, first to the right and then to the left, by means of electro-magnets which are acted upon by distant waves. The rotation of the disk causes a series of electric contacts. The whole is so combined that when continuous sparks are sent out, the disk does nothing but rotate forward and back under this action. Should these disturbing sparks cease, the operator has time to send out certain spark signals, which act upon the disk and its electric contacts in such a way that the mine is fired. These signals are combined in such way that they are known only to the operator. In the present apparatus, the waves are received by a new type of coherer illustrated in Fig. 1. It is a modified form of Dr. Branly's tripod coherer, and is made up of a polished steel cylinder, *A*, at the lower part. It is fitted on an upright support and from this three arms, *B*, hang down by means of pivots. The arms carry well rounded steel projections which bear lightly upon the cylinder so as to make the coherer contact. One wire, *C*, comes in at the top and the second wire, *D*, is connected to the steel cylinder through the base, *M*. The whole is inclosed in a vacuum chamber in order to protect the coherer from the action of the air, and by passing electric sparks in the upper part of the chamber it can be seen whether the vacuum is in good condition. Fig. 2 shows an automatic device for replacing the operator in order to send out signals for firing the mine at stated intervals. A cam works upon a rotating disk for this purpose, and the signals can be varied by changing the notches upon the disk.

Fig. 1.—Receiving instrument.

Fig. 2.—Apparatus for firing the mines at stated intervals.

A Typewriter Which Corrects and Manifolds

MANY suggestions for improving the typewriter have been made, but nobody seems to have gone so far as to expect a typewriter to correct any defective manuscript, producing a faultless document without any trace of correction in any number of copies. This is, however, what a German inventor, Mr. Oswald Poppe, of Gera, has achieved. His invention has been patented and a working model constructed.

The apparatus forms the table of an ordinary typewriter with which it may be so connected as to allow of its being dismounted at any moment. Whenever the typewriter has produced a defective manuscript the new apparatus is called upon to correct it. If any word or clause is to be eliminated, a special key is struck at the points corresponding with the beginning and end respectively of these passages. If, on the other hand, any groups of words are to be inserted a similar key is struck at the point of the manuscript where the insertion is to be made. The words to be inserted are then written at the end of the manuscript or on a paper tape placed underneath, a correcting key being again pressed down before as well as behind these words. The defective and corrected manuscript having then been removed, a new sheet of paper is put on the roll, after which a spring is wound up or some other motive force applied. The typewriter now prepares automatically a new faultless manuscript at high speed where there are no gaps, the lines being divided automatically at the end of syllables. The typewriter can thus be allowed to continue its work, producing any number of identical manuscripts, and inscribing, if required, automatically, a different address on every copy. The manuscripts thus obtained are not distinguished in any way from hand-type documents. The output of the machine can, of course, be multiplied by producing carbon copies.

The apparatus achieves this result by producing simultaneously with the manuscript a small pattern of plain paper which is about the same size. Each letter is marked in this pattern by two or three neat holes arranged in lines, which allow the letter to be reproduced on the keyboard. Leaves of patterns can be filed for reference or later reproduction.

The same principle can, of course, be applied to type-setting machines.

A Money-washing Machine

THE United States Government recently installed in the Treasury Department for experimental purposes, the machine for renovating bank notes and other bills recently described in these columns. The machine is about fifteen feet long and includes flexible belts moving face to face and properly manipulated to secure a scrubbing action upon the bills. The bills travel a distance of from 60 to 70 feet in passing through the machine and in such course pass through a washing solution, a germicide mixture and a starching or stiffening preparation, and are finally ironed and discharged in appearance and crispness practically new bills. The cost of producing a thousand bills is nearly fifteen dollars, while it is estimated that the cost of renovating bills by the machine in the manner described will not exceed in the neighborhood of fifty cents per thousand.

The Trade-mark as a Business Asset

By W. E. Woodward

[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value, that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the fourth of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

Analysis of the Requirements for Registration.—IV.

(*Continued from page 88, July 27th, 1912.*)

Great care should be taken by an applicant for registration of a trade-mark, or his attorney, to avoid conflict with a trade-mark that is already registered or already in use (even if not registered) provided that it is applied to the same class of merchandise as that of the applicant. Lack of caution in this respect has caused interminable annoyance and litigation, with consequent financial loss.

In considering the question of conflicting marks, the Patent Office and the Federal courts hold that the test of similarity is whether the marks are sufficiently alike in appearance or wording, or sound, to mislead the average individual. The word "Autola," as a trade-mark for cigars, was held not registrable, owing to a prior registration of the word "Auto-do" for the same class of merchandise. In this instance, registration was refused on the basis of resemblance in sound as well as in appearance. "Lady Lee" having been registered as a trade-mark for shoes, "Lady Like" was refused registration in the same class. "Certosa," as a mark for a brand of flour, sufficiently resembled "Ceresota"—already registered—to cause its rejection. "Powellton" failed registration as a trade-mark for coal, on the ground that another company's coal already bore the registered mark "Powell's Run." "Soda-foam" was considered close enough in resemblance to "Sea Foam" (already registered in the same class) to cause its rejection. "Uno," having been registered as a trade-mark for a medicine, an application for the registration of "Ino" in the same class was refused.

Registration is refused a trade-mark when it consists of words describing a symbolic or pictorial device which has already been registered; or *vice versa*, when the wording has been registered first, registration for the symbol is refused. For instance, the Patent Office has held that a trade-mark consisting of a conventional representation of a bouquet of flowers is identical in meaning with another mark consisting of the word "Bouquet," applied to the same class of merchandise. In either case, the goods would be called "Bouquet Brand."

Agreement among owners of conflicting marks is not recognized by the Patent Office. An interesting example of this occurred in the attempt to register the word "Nayassett." The word "Nassao" had already been registered for the same class of goods, and the registration of "Nayassett" was refused on the ground of similarity. Soon afterward, the owner of the "Nayassett" mark made new application, accompanied by the formal consent of the owners of the "Nassao" mark. The Commissioner of Patents held that the law did not provide for agreement between owners of conflicting marks, and the registration of "Nayassett" was refused accordingly.

About two years ago a manufacturer in a middle Western city became interested in a new metal polish and decided to put it on the market. After long consultation with advertising men and salesmen, a name was selected. This name was suggestive and short, with a snap to it that made it stick in the memory. Thousands of labels were ordered and packages of the article were given to the traveling salesmen of the concern to be used in getting orders from retailers. Booklets and literature had been written and mailed, and the business was beginning to take shape when, to the surprise of the manufacturer and his associates, his application for trade-mark registration was rejected by the Patent Office for the reason that the mark had already been registered. Then followed a hasty trip to a trade-mark attorney, and a search of the Patent Office records was made. Investigation of the register showed that the same name had been registered by an Eastern concern for a metal polish some years ago. About this time, a letter arrived from the attorney of the Eastern firm, with a statement to the effect that the owner of the trade-mark considered this unauthorized use of the mark an infringement and intended to take legal action in the matter. A month or two was spent in trying to make some arrangement with the Eastern concern, with the final result that the trade-mark had to be dropped and something new devised. In this case a full year was lost, and a considerable amount of money was wasted, by reason of the failure of this manufacturer to have a search made of the Patent Office records. He made the mistake of considering the matter of trade-mark registration a small detail, and trying to attend to it himself. A competent attorney would have saved his fee a thousand times over in this case.

A trade-mark consisting of the insignia of the American National Red Cross is not registrable. This prohibition is not covered by the trade-mark law, but is one of the provisions of the act of Congress incorporating the American National Red Cross (approved January 5th, 1905). This act of incorporation states that it shall not be lawful for any person or corporation to use in trade, or for purpose of advertisement, "the sign of the Red Cross" or "any insignia colored in imitation thereof," unless such person or corporation was entitled to the use of such insignia at the time of the passage of the act. This exception, which was intended to safeguard the interests of those who had long used the Red Cross sign as a trade-mark, covers the Red Cross mark of the well-known druggists' specialty house of Johnson & Johnson, the Red Cross labels used on a brand of shoes made by Krohn, Fechheimer & Co. of Cincinnati, the Red Cross mattress manufactured by a Boston concern, and a few other users of this device. The law, as it stands, is rigidly enforced in regard to all new trade-marks containing Red Cross devices. An unusual argument was made the basis of an application for registration of a label for a cough syrup, on which the emblem of the Red Cross was printed, accompanied by the words "Red Cross." When registration was refused, the applicant sought to amend the label by striking out the Red Cross emblem, while leaving the words intact. He argued that the Red Cross incorporation act prohibited only the use of the "sign of the Red Cross" and not the words. The application was rejected on the ground that it was an attempt to evade the spirit of the law.

A trade-mark is essentially an exclusive possession. When it ceases to be exclusive, it ceases to be a trade-mark, in the true sense. It is apparent, therefore, that an ordinary word, descriptive of the goods with which it is used, cannot be set aside as the exclusive property of any manufacturer, to the detriment of others producing merchandise of the same character. The wording of the law on this point is clear, and the Patent Office is strict in its interpretation. But despite this condition, many applications, destined to be rejected, are made every year for the registration of descriptive marks. We quote here a few examples of trade-marks refused registration on the ground of being descriptive:

The word "Kantleek" was refused registration as a trade-mark for a hot-water bag. The Patent Office examiner held that the word was composed of "Can't" (misspelled "Kant") and "Leak" (misspelled "Leek"), and that it was intended to convey the idea that this particular bottle could not leak. The attorney for the applicant presented an argument to the effect that this word was composed of two German words "Kant" and "Leek," that had meanings quite different from the English words with the same sounds. This contention was too subtle for the Patent Office to grasp, and registration was refused.

The word "Naphtha," used as a name for a soap with naphtha as an ingredient, was held to be descriptive and therefore not registrable as a trade-mark, to the exclusion of the goods of other manufacturers, although the owner had advertised it extensively.

"Mello," as a mark for chewing-gum, was considered descriptive, being simply a misspelling of the word "Mellow."

(*To be continued.*)

Notes for Inventors

A Cipher Typewriter.—The cipher typewriter, it is said, is coming into vogue among diplomats and business men. It is a machine by means of which a message can be written that can be read only by him for whose eyes it is intended.

Another Safety Appliance for Aeroplanes.—In a patent, No. 1,030,312, Henry Laprise of Holyoke, Mass., presents an aeroplane which is provided with a recessed top forming pockets in which collapsible floats are packed, the floats being adapted to be released from the stowage spaces and having bottom openings so that they may be filled and expanded with air from below.

A Poison-indicating Bottle.—In a patent, No 1,032,610, Emile A. Kern of West New York, New Jersey, presents a bottle for indicating poisonous contents, which bottle consists of inner and outer walls forming a chamber between them and a light-emitting compound in the chamber, which chamber is entirely closed and permanently confines the luminous compound in the chamber.

Primitive Lobster Traps.—If you have ever been in the lobster country, you will doubtless remember the traps, all alike and all made of laths. Laths are almost legal tender with the lobster catchers, and this fact makes a lath-laden derelict cast up on the shores of the lobster waters especially desirable. The traps are not especially secure, as lobsters frequently enter, eat the bait, and if given enough time, escape; and, possibly, some one acquainted with the conditions can devise a more efficient trap for the purpose.

Two Hollerith Machines.—Herman Hollerith of Garrett Park, Md., assignor to the Tabulating Machine Company, has just secured two patents, No. 1,030,304, for a registering apparatus, and No. 1,030,305, for an apparatus for use in tabulating systems. The apparatus presented in these systems is very complicated and is designed for use in the tabulating and registering processes which Mr. Hollerith has done so much to develop. It will be remembered that Mr. Hollerith was among the pioneers in this art especially in the designing of machines for use by the Census Office in its tabulating operations.

The Need of a Stripper for Crimson Clover Seed.—A botanist friend, specializing along agricultural lines, tells the writer that the small farmer needs an implement for gathering his crimson clover seed, that such seed is expensive and that, so far as he knows, there is no satisfactory device at present for gathering the seed on a comparatively small scale. The demand appears to be for a hand stripper of low cost which can be readily operated to harvest the seed without much loss. As the seed is expensive, such an implement would quickly pay for itself.

The Many Roads to Invention.—A well-known inventor, who for many years has invented along the same line and has made a great commercial success of his useful inventions, tells how he recently was led to make an important improvement in one of his machines. His young son asked him how the differential gear of his automobile worked. Wishing to give a correct explanation, he looked up the technical features of the transmission, and in doing so happened upon the very improvement he had hitherto been unable to complete, so that largely by accident he was able to produce a desired invention which had eluded him when deliberately sought.

Wanted a New Method of Curing Pork.—In a note from abroad, Consul Albert Halstead of Birmingham tells how the increasing use of pigskin and its tendency to advance in price has raised the question as to whether the great waste due to leaving the skin on bacon, ham and other pork products can be avoided. The English *Leathers Trade Review* estimates that there is a yearly loss of skins amounting to about $3,000,000 in the United Kingdom alone. The waste of skins is evidently unavoidable under present conditions; the difficulty is to find a method of curing that will prevent any loss of the meat if the rind or skin is removed.

Legal Notes

Disclosure and Priority.—In Hewitt vs. Weintraub (Mercury Vapor Lamps) the Court of Appeals of the District of Columbia, in affirming the decision of the Commissioner awarding priority to Weintraub, held that priority was properly awarded to Weintraub on the ground that the invention in issue is not disclosed in certain earlier applications of Hewitt, and said:

"Hence the appellant is here with the concurrent decisions of the tribunals of the Patent Office against him; and where this appears, as we have frequently said, we are loath to disturb such findings, especially where the invention is of a highly technical nature, such as this, unless it is clearly apparent that error has been committed."

Accounting for Profits.—The decision by the Supreme Court of the United States in Westinghouse Electric and Manufacturing Company vs. Wagner Electric and Manufacturing Company holds that where the infringer has sold or used a patented article, the plaintiff is entitled to recover all of the profits. Also that where a patent, though using old elements, gives the entire value to the combination, the plaintiff is entitled to recover all the profits; and that where profits are made by the use of an article patented as an entirety, the infringer is liable for all the profits "unless he can show—and the burden is on him to show—that a portion of them is the result of some other thing used by him."

Protecting the Flag.—Representative Cox of Ohio has introduced in the House of Representatives, a bill making the use of the flag or the coat-of-arms of the United States, or any pattern, imitation, or representation thereof, either by printing thereon or painting thereon or attaching thereto any advertisement or device for the purpose of gain or profit, or as a trade-mark or label, or the imitation or representation of the flag or the coat-of-arms of the United States for an advertisement, trade-mark, or label, a misdemeanor. The bill also provides that no copyright shall subsist in the flag or coat-of-arms or other insignia of the United States, or any simulation thereof. The bill also makes it a misdemeanor for any person to tear down, trample upon, or treat with indignity, or wantonly destroy the flag or coat-of-arms of the United States, and also provides for a fine not exceeding five hundred dollars or imprisonment not exceeding one year for violation of any of the provisions of the act.

[illegible] PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

FLYING MACHINE.—G. E. THOMPSON, 199 Howard St., Detroit, Mich. This easily controlled and balanced flying machine is adapted to float on water by means that form a fluid cushion between the water and the machine, whereby the device may be raised from the water. The invention provides a supporting plane, and means for rarefying the air or compressing the air at either end of the plane for balancing the same.

Electrical Devices.

WIRELESS MEANS FOR CONTROLLING AEROPLANES.—C. L. VANDERBURG, R. F. D., No. 2, Box 48, Fayetteville, Ark. This inventor provides a simple device by means of which the movements of an aeroplane may be so controlled that it will respond directly to the will of the operator, thereby avoiding the necessity of carrying a passenger to manipulate it. He also provides means for effecting aeroplane operations in dropping bombs or torpedoes.

AUTOMATIC DEVICE FOR TURNING MUSIC.—C. DALMONI and J. MACABIO, 49 Grove St., New York, N. Y. Means are here provided for turning music in sheets or in book form; and the invention comprises a combination of actuating elements by which a sheet or page can be turned in either direction. The music is engaged with sufficient force to move it from one position to another, and the actuating arm is always returned to its original position when released. Means provide for preventing waste of current furnished by the source

Of Interest to Farmers.

ADJUSTABLE SCRAPER.—N D. MCCOLLUM, Gore, Ga. This improvement relates to plows and cultivators, and the aim is to provide a scraper for attachment to a plow or cultivator, and more especially designed for scraping the ground on opposite sides of the plow point and sweeping it outwardly onto the adjacent rows of plants, hills or the like

CUTTER BAR FOR MOWING MACHINES—C. FALK, R. F. D., No. 1, St. Paul, Neb. This invention provides a removable extension for the cutter bar to augment the cutting capacity of a mowing machine, and provides means for splicing the extension and main frame of the cutter bar which is simple, economical and efficient.

COTTON CHOPPER.—R. HAMILTON, P. O. Box 711, Pensacola, Fla. The machine covered by this patent employs disk cutters arranged in pairs, the disks of each pair converging toward the front, and in connection with the disks, cultivator shovels are employed at the rear of the machine; the invention resides in a novel construction and arrangement of the parts for raising, lowering and otherwise adjusting the disk cutters and the shovels. There is also comprised in the machine a novel arrangement of guide wheel and its controlling lever.

Of General Interest.

TUBE.—J. W HAWKINS, 121 Union Ave., Passaic, N. J. This tube is commonly known as a paint tube, made of tin foil or similar material, for containing paint, tooth paste and other semi-fluid substances, the tube being arranged to open by pressure from the outside to govern the outflow of the tube contents onto a palette, tooth brush, spoon or like article, and to close the tube by pressure of the contents from the inside on release of outside pressure.

RACK FOR PAPER BAGS.—C. J. TABER, Bainbridge, N Y. This rack is for use in holding paper bags of various sizes and in a manner for convenient removal of bags singly of a desired size as required by the storekeeper, and arranged to permit of placing the rack in a flat, inclined or vertical position on a counter or other support, and to allow of filling each individual holder with a bundle of bags of a size corresponding to the holder.

PROCESS FOR BLEACHING OLD PAPERS, PAPER STOCK, STRAW, ETC.—J. H MELCHERS, McCanna, N. D. An object of this invention is to provide a process by means of which the coloring matter, ink, etc., may be removed from old papers so as to make stock of pristine whiteness. Further to provide a process for bleaching paper stock in which there are iron salts.

FOLDING CROSS.—H. T. WALROW, 66 Halsey St., Astoria, Queens, N. Y. Mr. Walrow's invention relates generally to articles of jewelry intended for ornamental purposes on watch chains, and more particularly involves a folding cross. The object is to provide a folding cross which will be pleasing in its appearance and well adapted to serve as an article of adornment.

MEASURING AND BAG FILLING DEVICE.—[illegible], 178 Border St., East Boston, Mass. This apparatus measures out quantities of material and delivers the same to containers. It is particularly applicable for use in filling bags with coarse material, such as coal. Coal is often sold in small quantities, and this device permits of the delivery of such a small quantity of extra coal as may be necessary to bring the quantity in the bag up to the required weight standard.

NON REFILLABLE BOTTLE.—M. HORNSTEIN, 184 Warren St., Jersey City, N. J An object here is to provide a simple closure for the bottle The inventor attains this by constructing the neck of the bottle in two parts and by disposing a gasket at the connection between the parts, which gasket supports a float valve having a limited movement off the seat.

UMBRELLA ATTACHMENT.—T. C. FREDRIKSEN, Astoria, Ore This invention more particularly comprehends a device designed to be secured on the handle portion whereby the umbrella may be conveniently suspended from

UMBRELLA ATTACHMENT.

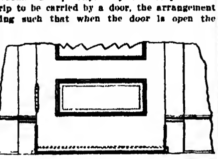
the clothing of the carrier. The device may be applied to any umbrella, and the inventor's purpose is to provide for suspending the device from the clothing when it is necessary to use the hands for other purposes, as shown in the illustration, thereby avoiding the tendency to mislay or lose such articles. The device may assume a variety of ornamental designs according to the style of handle employed

COMBINATION TRAY AND GLASS HOLDER.—J. HEAROLD, Richmond Hill, Queens, New York, N. Y. The object here is to provide a holder for use in saloons clubs, private houses and other places, and arranged for convenient attachment to a table or other support to conveniently hold a drinking glass and support cigars, cigarettes, ashes, and matches

FOUNTAIN PEN.—J. J MEAD, 390 Crescent St, Brooklyn, N Y In this patent the invention has reference to fountain pens of that type known as "self fillers" An object of the inventor is to form a fountain pen which will be quickly and easily filled without the necessity of removing the pen point

VENTILATING AND PERFUMING DEVICE.—P. KILLPATRICK, 4217 W. Kinzie St. Chicago, Ill. An object here is to provide a device by means of which pure air may be supplied evenly to the various parts of a room And further, to provide a device by means of which the natural perfumes of growing flowers may be supplied to the interior of a dwelling, hospital, or other building.

DOOR STRIP.—L J. VALENTINE, Plainview, Texas. This invention comprehends a construction adapted to be carried by a door for engagement with the floor or sill and provides a construction wherein air and wind with any particles carried thereby may be kept out of a room. The principal object is to provide a strip to be carried by a door, the arrangement being such that when the door is open the



DOOR STRIP.

strip is out of sight, coöperating with means carried by the door whereby when it is closed the strip will be moved into operative position adjacent the floor or sill. The strip is adapted to lie closely adjacent the floor when the door is closed, even though the floor be irregular or in a different plane than that intended The engraving shows a partial front view of a door with the casing therefor showing strip in operative position.

Hardware and Tools.

WEDGE.—W. WALTERS, Glendale, Wash. The object here is to povide a new form of wooden or iron wedge so constructed and reinforced that the wear and tear is taken off the metallic parts, and the stresses and strains incidental to an article of this character, are evenly and proportionally distributed over the whole surface.

CARPENTER'S GAGE.—M. B. MATHESON, P. O. Box 183, Duluth, Minn. The intention in this case is to provide a simple device for carpenters' use, and designed for quickly and accurately locating on a door the exact points at which to cut the openings for the key and knob of the lock, and the width and depth of the cuts for the hinges.

COMBINATION TOOL HOLDER.—W. L. HANE, care of Hocks & Duval, Ocala, Fla. The object of this invention is to provide a simple and inexpensive holder for use with lathe planer and shaper, wherein a single improved implement will perform the functions of three now necessary, and by means of which a great economy in time and labor is effected.

ENVELOP OPENER.—J W SINNOTT, 846 E. 146th St, Collinwood Station, Cleveland, Ohio This invention contemplates a tool having a guide slot or passage to receive the edge of the envelop to be opened with a knife or cutter located in the guide or passageway in position to engage beneath the flap as the envelop is moved along the guide or passage, or the tool is moved along the envelop

Heating and Lighting.

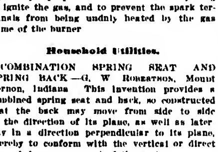
ELECTRIC GAS LIGHTER.—H D GRINNELL, Agricultural National Bk Bldg, Pittsfield, Mass. This lighter has spark terminals for convenient and quick attachment to the gas burner tip without requiring any constructive changes in the tip, at the same time directing the jump spark across the burner opening to ignite the gas, and to prevent the spark terminals from being unduly heated by the gas flame of the burner

Household Utilities.

COMBINATION SPRING SEAT AND SPRING BACK.—G. W ROBERTSON, Mount Vernon, Indiana This invention provides a combined spring seat and back, so constructed that the back may move from side to side in the direction of its plane, as well as laterally in a direction perpendicular to its plane, thereby to conform with the vertical or direct up and down movement of the seat

Machines and Mechanical Devices.

STRAIGHTENING PRESS.—J. JOHNSON, 413 Gvepp St, Bethlehem, Pa This invention straightens bars, cranks, and the like, without removing the same from their centers. Further, it arranges means for straightening the above, which utilizes the leverage action of a cam, and an even positive pressure caused by the



STRAIGHTENING PRESS FOR BARS, CRANKS, ETC

action of a screw moving the cam. Means provide for bending bars of any desired length, the means for accomplishing this being such as to accommodate bars of certain lengths without removing them from their supporting centers, and for accommodating bars of greater length than the device, by substituting auxiliary supports in place of the centers The engraving shows a fragmentary longitudinal sectional view through the structure

ANIMAL TRAP.—W A MAY, care of W H HARDEN, Quitman, Ga This is an easily cleaned mechanism wherein the entrance opening is normally open, and is closed by the entrance of the animal, and wherein other compartments are provided into which the animal may freely pass, but cannot return in order to permit the trap to automatically set itself.

MACHINE FOR MAKING STAVES.—T G MARTIN, 1029 Quincy St, Parkersburg, W. Va Mr Martin's invention is an improvement in stave machines, and has for its object the provision in a machine of this character, of new and improved means for cutting and equalizing staves, while the staves are being moved continuously through the machine

SHAFT HANGER.—G. C SPILLERS, Alexander Bldg., Tulsa, Okla. The improvement is in hangers suspended from ceiling plate or bracket; and the special feature is the adaptation of the hanger for adjustment of its movable members for the purpose of placing a shaft in different position as required to secure alignment or parallelism between different shafts.

PHOTOGRAPHIC SHUTTER.—J RICHARD, 25 Rue Mélingue, Paris, France. The invention relates to shutters for photographic apparatus and more particularly for stereoscopic cameras. The shutter is characterized essentially by the fact that the movement of the leaves of the shutter, in one direction or in both, is operated by percussion by means of a mechanical device independent of the leaves themselves.

CACULATING MACHINE.—NELSON STAFFORD, 67 Fulton St., Manhattan, N. Y., N. Y This inventor provides a machine wherein are imprinted in column form a succession of numbers, and wherein may be imprinted at will the totals of column sections, or the result of a succession of such totals; and provides means for exposing to view at will the composited number designed for addition to the column and number indicating the total of the column inclusive of the number composed for addition thereto

INTEGRATOR FOR CONVEYER BELT WEIGHING SCALES.—W P BUCHAN, Box 876 Kansas City, Mo This invention provides registering mechanism to display for record the total weight of material passed over a belt conveyer when operatively connected with the mechanism, and provides for recording accumulatively the total weight as the same is passed over the conveyer to which mechanism is attached, irrespective of rate of travel of the belt, whereby variation in the conveyer mechanism incident to load variation is instantly compensated

Prime Movers and Their Accessories.

INJECTOR.—W. H. LOCKE, care of Simms & Enslow, Thompson Pierce Bldg, Huntington, W Va The purpose here is to change the construction and action of various movable parts in order to increase the positiveness of the action of said parts and to enable the injector to be used under greater extremes of temperature of hot and cold water, as well as to increase the amount of pressure against which the injector will work

DEVICE FOR STARTING INTERNAL COMBUSTION ENGINES.—D E CROUSE, Annapolis, Md This device permits the starting of the engine through the action of a spring under tension, and the spring is restored to its original position after the engine is started. The starting of the engine is done by the movement of a rack into engagement with a pinion, with means for swinging the rack out of engagement with the pinion and causing its return to its original position, thereby permitting the pinion to turn freely with the engine shaft

Pertaining to Recreation.

ANIMATED TOY.—A GUND, Gund Mfg Co., 220 W 19th St, New York, N Y. This invention relates to wheeled toys, and its object is to provide an animated toy which simulates an animal, such as a dog, duck or the like, and when drawn over the floor moves certain members and at the same time emits sounds similar to those emitted by the animal simulated

Designs.

DESIGN FOR A BANK CHECK.—P E HASS, 51 Liberty St, New York, N Y One half of the area of this design for a bank check comprises a square of four double rings with bands to and from, in the center of which is a highly ornamental body of characters surrounding a center circle inscribed with the words Bank Safety Paper, and in the center of this ring is a U S shield and eagle

DESIGN FOR A CARPET OR A RUG.—G S. SQUIRES, 41 Union Square, New York, N. Y In this exquisitely ornamental carpet or rug the border involves the design of three bands or styles of geometrical patterns The field is flat with a heavy clustering of flowers in the corners, and a massive design for the centerpiece

DESIGN FOR A METAL PLATE.—J S LARSEN and A VALENTIN, 470 W 165th St., Manhattan,, New York, N Y This is a simple and effective ornamental design comprising a circular plate, the outer edge of which is pointed by an eight-point star, the base of whose angles joins an inside ring in whose center is a diamond. Small dots or rings are arranged around the plate.

DESIGN FOR A WATER CLOSET BOWL.—J AMIESON, care of Lambertville Pottery Co., Lambertville, N J In this simple and graceful design for a water closet bowl the distinctly original feature lies in the angular position of the inlet

DESIGN FOR A LOCKET.—C DAILEY, care of Klein & Sons, 14 Park Place, New York, N. Y In this ornamental design for a locket the little case holds a flat disk on which is pictured an upper half image of Christ, and on the reverse side that of the full figures of the Madonna and child

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each Please state the name of the patentee, title of the invention, and date of this paper.

VI.—Shall My Boy Become an Industrial Chemist?

By Prof. H. C. Peffer, Purdue University.

*[This is the sixth of a series of articles intended to set forth fairly the business possibilities of the technical professions. The articles are prepared by men who are connected with the more important technological institutions of this country and who are for the most part prominent educators. Because these teachers have instructed hundreds of young men in the principles of engineering, they are best qualified to write upon a subject so immensely important in the future development of American manufacturing industries.—*EDITOR.*]*

THE importance of the chemist to modern industry is daily becoming more manifest, due to recognition of this fact, his sphere has extended beyond the bounds of the strictly chemical and metallurgical industries, and he is called upon to take part in numbers of operations closed to him but a few years ago.

New opportunities lie in the fact that most of our great industrial institutions, in an effort to eliminate waste, improve their processes of production, or to find new outlets for their products, are founding research laboratories, employing numbers of trained men. One such firm has 250 men on its chemical staff; others have smaller numbers, but the significant fact is that a few years ago such a thing would have been deemed unnecessary. The result will be that the competitors of these firms will in turn be obliged to resort to systematic investigation of their processes, or fall behind in the race, with the further result that skilled chemical technologists will be in increasing demand.

This field of research is of the greatest interest to the chemist, because the greatest possibilities for the individual lie in this direction, and because our industrial development depends on its intelligent prosecution. It is not to be supposed, however, that the young college or university graduate is fitted to undertake independent investigations; in order to become a successful research chemist, the theoretical knowledge gained at college or university must be supplemented and reinforced by practical experience, and the faculties of observation and independent thought developed.

Neither is research the sole end of a chemical education; our industries are in need of technically trained executives and more intelligent supervision. In these days of large scale operations, increased attention is being given to the purchase of materials under specifications as to composition. This may mean, first, the employment of more analytical chemists, but beyond this, it means that primarily the material must be manufactured up to a given standard, which marks the passing of the old "rule of thumb" executive, and the advent of one of higher degree of technical training—the Chemical Engineer.

No mention has so far been made of this newcomer, who will share the field of Industrial Chemistry with the chemist, and who is in many respects better equipped than the latter. That the importance of the chemist has not been fully appreciated, up to the present time, at least, is no doubt due to the fact that his training has not fitted him to conduct the large-scale operations necessary in a manufacturing plant; to insure the highest degree of success in Industrial Chemistry, it is necessary to be able to carry through to a practical conclusion in the plant the principles worked out in the laboratory. This means, in addition to a thorough grounding in chemistry, additional training as mechanical and electrical engineer, the combination constituting the Chemical Engineer. The question of the proper college course for this branch of engineering has been under discussion for some time, and our attention will be directed rather to a consideration of the important period comprised in the years immediately following graduation, which exercise such a strong influence on a young man's future.

The college course in Chemical Engineering has of necessity been largely theoretical, and practical experience is necessary to the finishing of the young chemical engineer; this will come by contact with practical operations throughout the remainder of his career.

It has not been found possible to crowd into the compass of a four years course all the studies which should constitute the equipment of the chemical engineer; he will be fitted on graduation to enter a subordinate position in some industrial plant, and advance step by step, as his knowledge of details and practical experience increases. Most men stop here, but in order to make the most of the possibilities open to him, the young chemical engineer should, after a few years of practical experience, spend some time at a good university in further study. The degree which he obtains may be of little use to him directly, but his practical experience will have given him such a different point of view toward his work, that he should profit more in point of efficiency from his university than from his college course.

The necessity of starting at the bottom in industrial work is a great advantage; aside from the inevitable readjustment of his ideas as to his importance in the "plan of things," a young man's apprenticeship in a subordinate position results in habits of industry and punctuality and a knowledge of details which is not to be obtained otherwise. Criticism to which men of uninterrupted college and university training are too often open from the practical standpoint is that they fail to see the advantages of starting at the bottom in industrial work. They thus miss the intimate knowledge of details which the practical man possesses, also the advantages of contact with workmen and understanding of them, as well as knowledge of what constitutes a fair day's work.

It is essential that the chemical engineer be able to handle and deal with men, and on this rock many an otherwise good man has foundered. A term in the works is therefore advisable before completing the course of study indicated.

This may appear to be quite an ambitious schedule, but, to cite a familiar instance, it is just about what a young graduate in medicine must go through before he is competent to enter upon the practice of his specialty. Great stress is laid on the proper training for the chemical engineer, because, aside from the man himself, it is the thing of greatest importance; the leaders in this field will be those who combine practical ability with high scientific attainments, and other factors being equal, the man with the best preparation will be the most efficient.

The general question as to whether a college education is necessary to success along technical lines, is one which is frequently raised, the inference being that it is possible to secure such an education otherwise than by attending college. Granting for the moment that such may be the case, it should be possible to develop from the larger number of young men in the shops and factories at least as many efficient technical men as the colleges—which is not the case.

The question is not one to be settled by academic discussion; the test is that of utility based on the efficiency of the average technical graduate, as compared with the average non-graduate. Perhaps the most competent to pass on the question are those who come most closely in contact with both classes—the heads and executives of our great industrial enterprises; these men measure in terms of results, and their verdict comes in the shape of demand that applicants for a constantly increasing list of positions shall be technical graduates. To use another familiar instance, the sales forces of most progressive firms are now largely recruited from the ranks of technical graduates, whereas a few years ago the practical man had the field largely to himself.

For the chemist or the chemical engineer a college training is a necessity. It may be possible for a bright, determined young man, employed in some line of industry, to acquire by his own efforts a limited knowledge of the chemistry of that particular

[illegible] will be [illegible] only as long as [illegible] present themselves, and [illegible] elsewhere. The day of the [illegible] man in technical lines is past; the fields of chemistry are so wide and diversified that no man, however able and industrious he may be, is able to make much headway unaided. Competent instruction and the proper equipment for experiment are needed; the college and the university, which have specialized in this department, afford the only means open to the average young man for proper instruction.

Quirigua

(Concluded from page 97.)

9.19.0.0.0 9 Ahau 18 Mol at Quirigua is, that it is the latest date yet found at this city, and indeed for that matter, one of the very latest in any of the southern Maya centers. With the coming of Cycle 10 the great southern cities rapidly declined, and only two or three of them show dates later than the close of katun 19, which is inscribed here on Structure 1 at Quirigua.

In addition to Structure 1, a low and much smaller mound, some 30 feet southwest of it, was excavated, and this proved to be a building of the dwelling type. (See Fig. 2, where Structure 2 appears in the foreground to the right.)

This latter building was perhaps of greater interest than its more imposing and pretentious neighbor on the terrace behind. To begin with, Structure 2 is older than Structure 1. Indeed, the terrace upon which the latter stands was built *around* Structure 2, covering it up to within 6 or 7 feet of its roof. Only the north side of Structure 2, that containing the doorway, was left open. (See Fig. 2.) The covering up of three sides of this building by the terrace of Structure 1, doubtless made for its preservation; and to this fortuitous circumstance alone we are indebted for the solution of several important architectural problems. Until the excavation of this building it had been a disputed point whether the treatment of the façade above the medial cornice—i. e., the upper half—had been sloping like a Mansard roof or vertical. Both methods of treatment had been found in other Maya cities, but heretofore no façades, either at Quirigua or Copan, were standing to a sufficient height to determine this important point. In Structure 2, however, enough remained to show that the upper half of the façade sloped backward. Although this same fact could not be positively established in connection with Structure 1, because of its greater demolition, nevertheless, by analogy, the writer believes that it also may be regarded as having had the upper part of its façade sloping. Probably the same may be said of all other buildings, both here and at Copan.

Structure 2 yielded more specimens than Structure 1. A number of pieces of pottery were recovered, including a very fine painted fluted vase with a grotesque human head on one side. Many mother-of-pearl beads were found, but long exposure to the moisture had rendered them crumbly and rotten. A few jade beads were also found, but they were small and in no way worthy of note. The most unique find in Structure 2 was a series of worked hematites. These were hexagonal in shape, about one sixteenth of an inch in thickness and not over one inch in width between the two points. One side was very highly polished in each case, the other being ground smooth. The edges were beautifully cut; and some of the fragments showed a round edge, as though such pieces had formed the border of some mosaic. The purpose for which these were used is unknown; and so far as the writer is aware, nothing like them has ever been found.

An interesting feature, tending perhaps to confirm the identification of Structure 2 as being of the dwelling type, was the stone hooks which were found in the walls on both sides of every doorway. These were about four and one half feet above the level of the floor in each case, and [illegible] used for hanging curtains across the doorways, a much needed protection in the rainy season. In some cases another pair were found on the floor level, so that the hanging could be secured both at top and bottom from flapping in the wind. These hooks always had their points upward, so that loops could be easily placed over them. Nothing of this kind was found in Structure 1. The false arch, by which *all* Maya structures are roofed,* was standing to the height of the capstone in this building. This type of roofing is made by projecting the courses of two opposite walls slightly beyond the courses next below them in each case, and continuing this operation until the walls have been drawn close enough together to be bridged with a capstone. From this building it was thus possible to ascertain the approximate height of the rooms here at Quirigua, i. e., about nine or ten feet.

The quarries from which the building stone was obtained are some two and a half miles west of the city. The material in Structure 1 is a sandstone of rather fine grain, while that in Structure 2 is a volcanic rock, much harder and stronger. Both were worked with stone chisels, basalt being the commonest material. Several such chisels were found during the course of the excavations. They varied from 4 to 6 inches in length, had but one cutting edge, and were shaped to fit the hollow of the hand. There was no indication that they had ever been supplied with any form of handle.

In addition to the specimens collected, the most important results of the season's work were (1) the discovery of the new hieroglyphic texts and the exceedingly important data which they present, (2) the discovery that the upper half of the façade in Structure 2 was *sloping* rather than vertical, (3) the discovery that all sculptured stones were originally covered with a coating of white lime plaster varying from a very thin slip to one half inch in thickness, and (4) the discovery that Structure 2 was of greater antiquity than Structure 1.

* Throughout the length and breadth of the Maya area, from Yucatan in the north to Honduras in the south, and from the Isthmus of Tehuantepec in the west to British Honduras in the east, the writer knows of not a single authentic case of a Maya building having any other kind of a roof. John L. Stephens ("Incidents of Travel in Yucatan," Vol. II., pp. 281, 282) claims that he found a flat ceiling at Tuloom, on the east coast of Yucatan, but this statement has never been verified.

New System of Electrically-heated Hot Water Supply

A DISADVANTAGE of the electrical heating of hot water for general domestic supply is that when the temperature of the volume of water is lowered on drawing off a considerable percentage of the total amount by the incoming cold water, a long time is required to regain the normal temperature. To avoid this difficulty a form of electric heater has been devised in which part of the water only is heated directly by electrical energy, the remainder being heated indirectly by the first part. An inner cylinder contains the portion to be heated directly by an immersed resistance unit. The remainder of the water is contained in an outer jacket and receives heat from the inner cylinder through a wall. In order to allow the inner volume (from which the draw-off pipe runs) to become hot enough in a short time, the separating wall is designed to hinder the flow of heat to some extent. Thus the electric heating is applied to only one third of the total volume instead of to the whole, so that the temperature rises much more rapidly than by the ordinary arrangement.

A Polar Drift à la Nansen

ACCORDING to the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* a Spanish expedition under Señor Gisbert will embark this summer at a point near Point Barrow, Alaska, for a drift of several years in the North Polar Basin, after the example of Nansen's famous journey in the "Fram."

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12666) E. L. B. writes: *Re* item "An Ingenious Weather-cock," under Notes for Inventors, on page 589 of your valuable journal, I wish to advise that an indicating device similar to that referred to was described in *Amateur Work*, vol. 1 (June, 1902) pages 180 to 183, inclusive, four figures, under the caption "An Electric Wind-vane," by Paul M. Benedict. This device uses commutated currents in connection with "electro-magnets and compass" indicator. Also see "An Electric Wind Vane," by C. E. S., the *Model Engineer and Electrician* (London) vol. xix, No. 375, pages 11 to 13, inclusive, and No 376, pages 27 to 30, inclusive, seventeen figures. (July 2nd and 9th, 1908.) Indicator works on the principle of the annunciator. Being interested in meteorology, I have designed an electro-magnet indicator, utilizing a soft iron armature instead of a compass needle, the armature being kept in synchronism with the wind vane by means of a special commutator, which shifts the current from closed circuit batteries through the several magnets in proper sequence. I have also used a special rheostat operated by the wind vane and in circuit with an ammeter directly calibrated to show direction. I have no desire to discourage inventive research in this particular, but as the devices enumerated above cover the field pretty thoroughly and quite satisfactorily, there is not a great deal left for the "successful inventor" to invent. A We thank you for your interest in the matter of the electrically indicating wind vane Your observations are quite true There is no glory nor gold here for an inventor to obtain; but there is for the amateur who is possessed with the laudable desire to "make something" We have ourselves devised several arrangements of this sort in our own weather observations. There are always new men coming up who wish for such devices That is of course our reason for publishing such plans as we do in our Laboratory at Home and the Workshop section. It is not that they are absolutely new or wholly original, but that these devices will meet some one's eye who is just now in want of some such thing Any reader wishing to refer to the original description will find it in Vol. 106, No. 26, on page 589.

(12667) K. B. says: 1. What is the lightest known gas? How is it obtained? A. The lightest known gas is hydrogen The decomposition of water by electricity yields this gas It may be generated by the action of hydrochloric acid upon zinc, forming zinc chloride and liberating the hydrogen which the hydrochloric acid contains. When a piece of sodium is dropped into water, the gas which comes off is hydrogen This is too expensive for commercial purposes. The action of warm sodium hydroxide upon aluminium causes the evolution of hydrogen from the sodium hydroxide and the formation of aluminium hydroxide. The first method given is the cheapest and the one most generally employed for obtaining hydrogen. 2. What kind of gas passes off in the charging of an Edison storage battery? What is its relative weight to air? A. Hydrogen is evolved in the charging of the Edison storage battery from the decomposition of water Hydrogen is about 0.07 as heavy as air, more exactly, it is 0 0696 times as heavy as air 3 How much will a cubic foot of gas 25 per cent lighter than air lift? A. A cubic foot of air weighs 0.08 pound. A cubic foot of a gas which is 25 per cent lighter than air would weigh three-fourths as much as air, or 0 06 pound. In air it could, therefore, lift the difference between its weight and the weight of a cubic foot of air, or 0 02 pound.

(12668) W. F. says: If it were possible to take a compass over a line where there is no declination, and reach the North Pole, would the needle turn around? That is, would it continue to point to the north after passing over the pole? Such is the result when a compass is moved around a sufficiently strong magnet. A. If an ordinary compass needle, which is pivoted so as to swing in a horizontal plane, were carried along a line of no declination to the North Magnetic Pole, it would point to the true north until the Magnetic Pole was reached. When it was over the pole it would not have any directive power, that is, it would stand indifferently in any direction it happened to assume. If it were now carried forward toward the earth's geographical north pole, the needle would be reversed, and the north end of the needle would still point toward the magnetic pole it had just left. The needles of compasses point toward the magnetic and not toward the geographic poles of the earth. If a magnetic needle is hung so as to swing in a vertical plane, and carried toward the north, its north end will turn down as it proceeds until it arrives over the Magnetic North Pole, when it will stand in a vertical position, its north end being downward toward the earth. As it is carried on toward the earth's north geographical pole, the north end of the needle will be directed more and more toward the south, the pole it has left behind it.

NEW BOOKS, ETC.

THE OLD CLOCK BOOK. By N. Hudson Moore. New York: Frederick A. Stokes Company, 1911. 12mo; 339 pp.; 104 illustrations. Price, $2.40 net.

Those who have enjoyed and profited by "The Old China Book" and "The Old Furniture Book" will be pleased to hear of this very charming volume by the same author. English clocks are historically dealt with and described in the first of the two main divisions of the work, and American clocks and clockmakers are familiarly treated in the second division. The absence of available literature dealing with the earlier clockmaking activities of this country gives Mr. Moore's volume an added value, though the records are at best but sparse, and the products elusive. "Wag-on-the-wall" clocks were made in quantities in America up to 1830, but the author wrote forty-two letters in the effort to find an American clock of this style, without the least success. An illustration of one is given, but its standing as an American-made article seems doubtful. Speaking of illustrations, the plates accompanying the text will be a delight to all those of antiquarian tendencies. Every shape and size is here, in every degree of simplicity and ornamentation. The peculiarities indicating various makers are pointed out, and other means of identification are given. The care and repair of old-fashioned timepieces is condensed from the directions of Chauncey Jerome. A list of clockmakers, English, Continental, and American, concludes the volume.

MANNHEIM AND MULTIPLEX SLIDE RULES. By L. W. Rosenthal. New York: The Eugene Dietzgen Company, 1911. 16mo.; 67 pp. Price, 50 cents.

The slide rule is of such universal application, and is so simple to operate, once the principles are well understood, that it is extraordinary that the number of rules in use is comparatively few. The present volume tells how to use both the Mannheim and multiplex slide rules, both of which are excellent. Perhaps the most interesting chapter in the little book is that devoted to conversion ratios, dealing with geometrical ratios, ratios of length, ratios of area, ratios of capacities, ratios of weights, ratios of velocities, ratios of weights, lengths, etc., ratios of capacities and weights, ratios of pressures, ratios of work, and ratios of unit cost.

ELEMENTARY GRAPHIC STATICS. By W. J. Crawford, D.Sc. Philadelphia: J. B. Lippincott Company, 1911. 12mo.; 131 pp.; illustrated. Price, $1.

A short time ago we took occasion to mention favorably a textbook by Cathcart and Chaffee entitled "The Elements of Graphic Statics." This has been condensed and, with the matter mainly confined to the properties and general uses of the force and equilibrium-polygons, appears as "A Short Course in Graphic Statics." The "Elementary Graphic Statics" of W. J. Crawford presents another short course. Both are good, but while the first-named excels in plan and arrangement, and in some respects goes more deeply into its subject, the latter starts with simpler definitions, constructs simple apparatus, includes review questions, and will probably prove the more attractive to the absolute tyro.

CONCEALING-COLORATION IN THE ANIMAL KINGDOM. An Exposition of the Laws of Disguise through Color and Pattern. Being a Summary of Abbott H. Thayer's Discoveries. By Gerald H. Thayer. New York: The Macmillan Company. 4to.; 260 pp.; 16 colored plates and 57 black-and-white plates. Price, $7 net.

It is fitting that a book setting forth the observations and deductions of an artist should be a magnificent specimen of the typographer's art, and the publishers are indeed to be congratulated upon the result. The author defines concealing-coloration as simply that which enables the wearer to be mistaken for certain details of the scene, and his discovery—or theory, if you prefer it—is that almost every living creature reproduces in marking and tinting the background of his natural habitat. No matter how conspicuous an object he may be when removed from his own domain, while there his costuming is that best fitted to melt into its surroundings and endow its wearer with a gift approaching that of invisibility. The supreme feature of the volume is its remarkable illustration, in which birds, beasts, fishes, reptiles, and insects are shown with scientific and artistic accuracy beneath the light, and with the background, of their native haunts, where the concealing function of their markings has free play. We understand the volume was eight years in preparation. It certainly represents a vast amount of sympathetic and intelligently ordered labor, and offers much material for thought and for further trained investigation.

ELIZABETHAN INTERIORS. By C. J. Charles. London: George Newnes, Ltd. New York: F. Greenfield, 1911. Folio. 40 pp. Numerous plates.

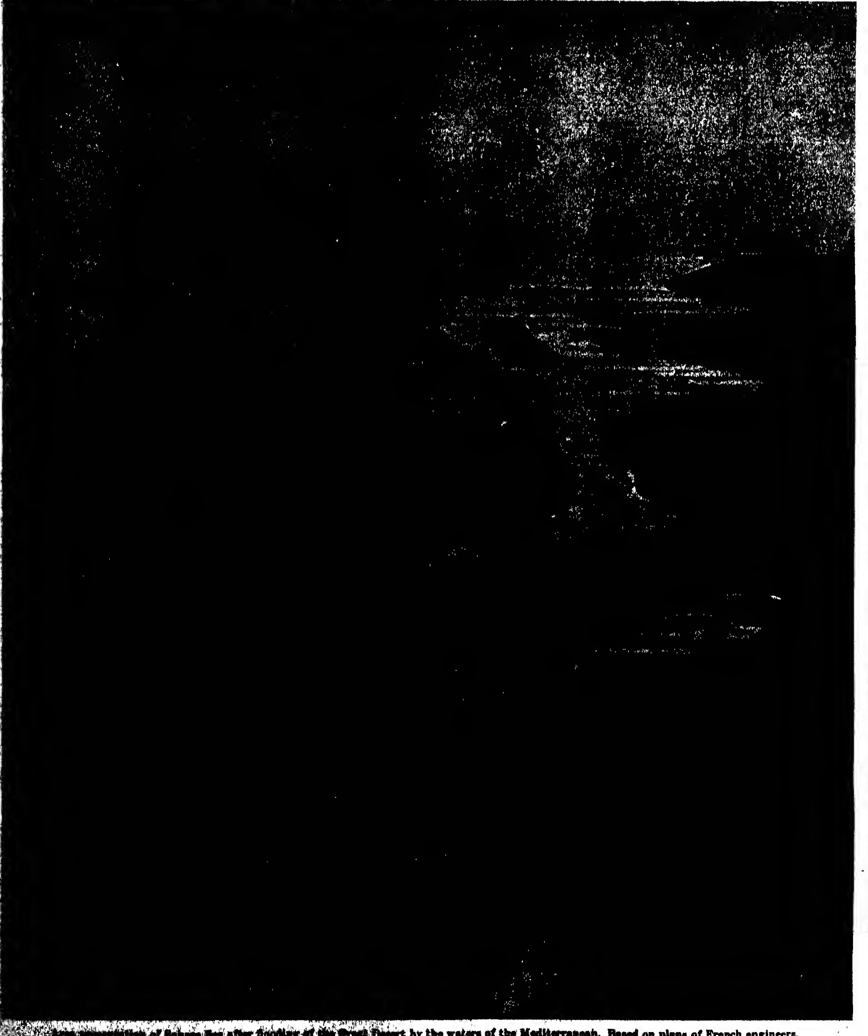
This superb work is printed from original plates, etchings, and drawings, and the selection of them is most admirable and the plates beautifully reproduced. It is, in fact, a book which will be welcome to the libraries of all architects and connoisseurs. The text, which is beautifully set in very large type, is printed on handmade paper, the impression being sunk into it to match the plate marks of the plates themselves. It is attractively bound in morocco and boards. The purity of the Elizabethan style and its adaptability to more pretentious homes is well brought out. The examples shown include many interiors in this country. The first edition consists of 900 copies. It is one of the most attractive architectural books

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

[illegible] NEW YORK, AUGUST 10, 1912 10 CENTS A COPY $3.00 A YEAR



[illegible] of Sahara Sea after flooding of the Great Desert by the waters of the Mediterranean. Based on plans of French engineers.

CONVERTING THE SAHARA DESERT INTO A SEA.—[See page 114.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, AUGUST 10, 1912

Published by Munn & Co Incorporated Charles Allen Munn, President
Frederick Converse Beach Secretary and Treasurer;
all at 361 Broadway New York

Entered at the Post Office of New York N Y as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico Cuba and Panama	
Subscriptions for Foreign Countries one year postage prepaid	4 50
Subscriptions for Canada one year postage prepaid	3 75

The Scientific American Publications

Scientific American (established 1845)	per year	$3 00
Scientific American Supplement (established 1876)		5 00
American Homes and Gardens		3 00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

Board of Trade Report on the "Titanic"

TO the readers of the SCIENTIFIC AMERICAN the most interesting portion of Lord Mersey's report on the loss of the "Titanic" will be those sections in which he makes recommendations as to the elements of safety which should be incorporated in the construction of future passenger steamers. From the very first this journal has held that the most serious feature of the loss of this vessel was the fact that she went to the bottom so soon after the collision, and we have shown that her failure to remain afloat until the rescuing vessels could reach her was due to the omission from the ship of certain protective features in the way of more complete sub-division which, had they been present, would probably have prevented the loss of a single life.

Lord Mersey attributes the loss of this ship primarily to high speed and an insufficient lookout. He would have been closer to the facts if he had stated that the collision was due to these causes and the loss of the ship to her insufficient sub-division below the water line. By implication if not by direct arraignment the report must be taken as a scathing indictment of the provisions of the Board of Trade, and the public may rest assured that these recommendations, following along very much the same lines as those to be found in the report of the Senate's Investigating Committee, will lead to some very thoroughgoing reforms in the Board of Trade. It is naturally gratifying to the SCIENTIFIC AMERICAN to note that the recommendations of a structural character made by Lord Mersey are identical in character and number with those which were suggested by this journal in its first analysis of this disaster made within a few days of its occurrence.

It is recommended that the Board investigate the practicability of providing sea-going ships, in addition to their watertight transverse bulkheads, with a double skin carried above the water line, or with a longitudinal vertical watertight bulkhead on each side of the vessel, or with both. The Board is instructed to investigate the question of providing a watertight deck or decks, stretching along the whole or part of the length of the ship at a convenient distance above the water line, and it is to determine whether the openings should be watertight doors or some other device.

It is further recommended that the subdivision of the vessel should be so adjusted as to keep the ship afloat with the greatest proportion of her length in communication with the sea. This of course refers to the present provision, which contemplates only two adjoining compartments being open to the sea. This provision should certainly cover three or even four compartments.

A most important recommendation is that the Board of Trade be empowered to enforce their conclusions on the foregoing points, and to require that the designs of ships should be submitted to it in the early stages of their construction.

We have frequently pointed out that ships which embodied these constructive features would be practically unsinkable—that at least they would remain afloat long enough for rescuing vessels to transfer the passengers. To this extent they would serve as their own lifeboats. Nevertheless, in view of the fact that the majority of ships are not built along the lines suggested in this report, we are glad to note that Lord Mersey recommends that the lifeboat accommodations on sea-going vessels be based on the number of persons carried instead of on the tonnage of the ship, and that they be sufficient for all on board.

Important also is the recommendation that an international conference be called to agree on a common rule for the sub-division of ships, also as to life-saving apparatus, wireless regulations, speed in the ice regions and the use of searchlights.

A Bureau of Farm Power

THAT highly efficient department of the Federal Government which is devoted particularly to the interests of the farmer, contains among its subdivisions a bureau for the investigation of soils, a bureau of chemistry for the analysis of fertilizer, a bureau of plant industry to study the bacteriological problems connected with plant production and plant nutrition, a bureau of entomology to obtain and determinate information regarding injurious insects affecting field crops, fruits, etc., a bureau of biological survey which recommends measures for the preservation of beneficial and the destruction of injurious species of birds and mammals, a bureau of animal industry for the inspection of animals, meats and meat food products, and the investigation of dangerous diseases among live stock, and a weather bureau which will keep the farmer informed as to meteorological conditions. It would seem that with all these different bureaus the interests of the farmer were well taken care of. However, there is one important branch of farming that has been entirely ignored by the Department of Agriculture, namely the subject of farm power. The American farmer has outgrown the age of hand labor and even animal labor is now on the wane. Steam power was introduced on the farm many years ago and of late the internal combustion engine has been playing a very important part and now electricity is beginning to be used.

The epoch of mechanical power on the farm has already begun, and it is important that farmers be educated upon matter pertaining to labor-saving machinery. Realizing this need, Mr. H. T. Rainey of New York city introduced a bill in the House of Representatives last month to establish in the Department of Agriculture a Bureau of Farm Power. The province and duties of the bureau are "to investigate and report upon all matters pertaining to methods of furnishing power on farms and all labor-saving machinery adapted for use on farms and the use of electricity, gasoline and steam in propelling farm vehicles in operating plows, reapers, mowing machines, threshing machines and other machines and implements used in planting, cultivating, harvesting and marketing corn, wheat, oats, potatoes, hay, rice, vegetables and all other agricultural products.

"It shall be within the province of said bureau to make diligent investigations into the matter of machines and labor-saving devices used in the dairying industry as conducted on farms and into the methods of heating and lighting all farm buildings. In general, said bureau is authorized and directed to investigate diligently all machinery and devices which will lessen the amount of labor necessary in agricultural pursuits and lessen the expense of producing and marketing such of the necessaries of life as are produced on farms and to report the results of said investigations to said Department of Agriculture."

We hope that Congress will see fit to establish this much needed bureau.

A Question of International Good Faith

"ARTICLE 3. The United States adopts as the basis of the neutralization of such ship canal the following rules, substantially as embodied in the Convention of Constantinople signed the 28th of October 1888 for the free navigation of the Suez Canal, that is to say: 1. The canal shall be free and open to the vessels of commerce and of war of all nations observing these rules, on terms of entire equality, so that there shall be no discrimination against any such nation, or its citizens or subjects, in respect of the conditions or charges of traffic or otherwise."

The above quotation is from a treaty concluded in 1901 between the United States and Great Britain, known as the "Hay-Pauncefote Treaty," in which, in consideration of certain concessions made by Great Britain the United States agreed, among other things, to operate the canal under similar conditions as regards the ships of all nations making use of the canal.

There is now before Congress a bill which proposes to remit the tolls on ships flying the flag of this country.

It does not take a legally-trained mind to see that such exemption would be a distinct breach of faith on the part of our Government. The question is one of simple, every-day morality. Questions of moral right are universal in their application, and the code of honor is as strict in its [illegible] Government like our own as [illegible] citizen. Is it not indeed [illegible] breach of faith on the part [illegible] himself only, whereas a breach [illegible] the United States Government [illegible] of the ninety-five millions of people who live under its flag?

The peril of the present [illegible] good faith lies in the fact that the [illegible] clouded by sophistry. Specious catchwords and misleading phraseology may easily divert the [illegible] a busy people from the real points at issue in a controversy of this kind. "We built the canal; why should we not make the other people pay for it?" "The United States has invested nearly $400,000,000 in this enterprise, and why should we be called upon to play the part of the philanthropic benefactor, by charging our own ships the same rate of toll as we charge the ships of other nations, who have contributed not a single dollar to the great work?" The answer to all this is, that our Government, after a careful review of the whole situation, and in view of the collateral advantages to be secured in the way of the abrogation of previously existing treaties affecting the Isthmus, and the pledge of Great Britain that the Canadian and the Suez Canals shall be operated on terms of equality, did enter into a solemn agreement to operate the Panama Canal upon terms of equality; and if the United States Government should now violate that treaty by operating the canal upon terms of inequality, it will stand condemned in the eyes of the whole world as having committed an act of international dishonor.

Furthermore, the exemption of United States ships from the payment of tolls would be to divert a portion of the reasonable profits of the canal into the pockets of certain private corporations. We cannot shut our eyes to this fact. The remission of these tolls will not mean the return of any profits of operation back to the National Treasury, and no amount of argument can possibly show that it will. It is urged, of course, that the remission of tolls will serve as a powerful stimulus to the upbuilding of our merchant marine. But we are not by any means prepared to admit that it would. What we do claim, however, is that whatever collateral benefits might be secured, it is impossible to overlook the fact that the gain would be made at the cost of our national reputation for honor and square dealing.

The SCIENTIFIC AMERICAN, as our readers well know, is an earnest advocate of the upbuilding of our shipping industry, but upon mature consideration we feel that this expedient of remitting Panama tolls is not, and in the nature of things, never can be, the legitimate way to achieve this object.

The construction of the Panama Canal must rank as the greatest achievement of a physical character that has ever been undertaken and successfully put through by the United States. We have gained an enviable reputation thereby, and in this particular field our prestige as a great engineering people has been immeasurably increased. It would be a lamentable commencement of the operation of the canal if we were to cloud this great project by following a course which would bring down the condemnation of the whole civilized world.

"Making" Rain in Battle Creek

ON July 23d Battle Creek, Mich., "put itself on the map" (to quote a local paper) by holding an exhibition of the alleged efficacy of dynamite in producing rain. If the purpose of the exhibition was to attract a large and lucrative influx of visitors for the benefit of the community in general, or to advertise the wares of a local manufacturer who financed the enterprise, or, finally, to promote the sale of explosives, then the citizens of the Michigan town are to be congratulated upon the results of their efforts. Mention should also be made of the moving-picture men, who were present in force to make the most of an unusual event. About 4,500 pounds of dynamite were exploded in the course of the afternoon. A rain area of a hundred thousand square miles, more or less, which had been drifting eastward from the Dakotas since the previous morning reached Battle Creek the day of the explosions; in fact it was drizzling at that place some hours before the firing began, and heavy showers fell all over southern Michigan in the course of the day. In spite of these facts, the rain-makers claim that the particular fraction of the general rain storm that occurred in their vicinity was the result of the explosions. It is entirely superfluous to comment upon this claim, beyond saying that the rain-making hallucination is, apparently, one of the incurable forms of mental disease. Of course any one with a slight knowledge of meteorology, and the current weather map at his disposal, could have "made" rain at Battle Creek on the day in question in the same way in which the [illegible] in a savage country, having a convenient almanac at hand, "makes" an eclipse of the sun or the moon in order to impress the natives.

Engineering

Quantity of Canal to be Dug.—On July 1st, the grand total of canal excavation was 173,269,815 cubic yards, leaving to be excavated 22,063,564 cubic yards. This means that more than one-eighth of the entire amount necessary for the completed canal remains to be excavated.

Electric Power from Gatun Lake.—Electric power will be used almost exclusively for operating the Panama canal. The hydro-electric station will be situated adjacent to the north wall of Gatun spillway and the installation will have a capacity of 6,000 kilowatts. The average hydraulic head throughout the year will be about 75 feet. The maximum quantity of water diverted for hydro-electric development will be approximately 7 per cent of the minimum water supply, and will be the excess which is not required for lockages, evaporation, and leakage.

Cuniberti Favors Life Pontoons.—The pontoon method of saving life in the event of the foundering of a ship, as illustrated recently in the SCIENTIFIC AMERICAN, finds an illustrious advocate in Cuniberti, the chief naval architect of the Italian navy. He believes that the upper aft portion of a ship, containing the cabins, etc., should be constructed of wood and form a structure independent of the rest of the ship. This should be bolted to the hull by fastenings which could be readily unlocked in the event of the loss of the ship. Fred T. Jane, who mentions the fact in the *Navy*, suggests that the idea is not any more far-fetched than the idea of building dreadnoughts when it was first suggested by Cuniberti.

Lexington Avenue Subway, New York.—The largest work of subway construction now being carried on in the world is that being done below Lexington Avenue in this city. The line, which will be four-track throughout its entire length, is about 10 miles long. Eight of the 10 miles are now under active construction, and the total cost of the work on this 8 miles alone will be over $35,000,000. Over 3,000 men are engaged on this section. Work is also being prosecuted on the four-mile, four-track subway on Fourth Avenue, Brooklyn, and the Center Street loop subway is being completed. Altogether on the three systems there is now under contract about $81,000,000 worth of work, covering 13½ miles of four-track roads.

A Forty-knot Hydroplane.—England is again about to make an effort to recapture the Harmsworth cup for motor boats, which is now held in America. Four boats have been built, and of these the fastest is the "Maple Leaf IV," a 40-foot boat, with engines of about 600 horse-power. In a contest recently held, the "Maple Leaf," over a 33-knot course, maintained the remarkable speed of over 40.03 knots or about 46 miles an hour. Considering the length of the course this is certainly an extraordinary speed; and in view of the fact that several boats have been built in this country which are credited with equally high speed (that is to say, if the newspaper reports are correct), we may look for an excellent contest this summer on Long Island Sound.

Reduce Railway Speed.—The Public Service Commission found that the breaking of the rail which caused the wreck of the Twentieth Century Limited was largely due to the high speed of the train, and it referred to the schedules as being "too fast for safety." On the other hand, we notice that recently the engineers of the Union Pacific Railroad stated that the breaking of rails could be prevented by putting more metal into the base. Both points of view are correct; but we are inclined to agree with the Public Service Commission that, as matters now stand, and in view of the heavy wheel loads, the rail is not equal to its task. If rails were heavy, and if the specifications were stricter and the process of manufacture were carried out with greater care, railroads could run their trains as fast and even faster than they do to-day, with impunity. It is quite possible to manufacture rails which will stand up under any traffic whatsoever; but it is certain that the average rail used to-day on American railroads is not equal to its duties.

Double-deck Cars for New York.—It is reported that the Interborough Company is studying the question of the introduction of double-deck cars in New York city. This is the right idea; indeed, the SCIENTIFIC AMERICAN, many years ago, had a series of articles strongly advocating the use of this type. The introduction of an upper deck practically doubles the capacity of the car, without involving any proportionate increase in the weight or in the power necessary to drive it. The number of passengers per unit of length is doubled, and when the public get accustomed to this type, we believe that there will be very little increased delay at the stopping places, due to the larger number of people boarding or leaving the cars. The low car which is running experimentally in New York would be well adapted for double decking, as the total height of such a car with another deck would not be so great as to interfere with the overhead structures, at least on many of the crossings in the city.

Science

Mt. McKinley.—A telegram has been received from Mrs. George Brown, mother of Belmore Brown, the companion of Prof. Herschell Parker on his third attempt to ascend Mt. McKinley. The telegram states that a height of twenty thousand feet was reached, which means that the summit is still unconquered.

Plans of Capt. Amundsen.—The discoverer of the South Pole expects to return to Europe in September and will make a series of addresses before the principal geographical societies, beginning with the Norwegian Geographical Society in Christiania. He is to address the Royal Geographical Society in London on November 18th. The Norwegian Storthing (parliament) has voted him a grant of 136,365 kroner (about $36,818) toward his prospective north polar expedition.

The Cost of Discovering America.—The English newspapers print a report from Madrid to the effect that some ledgers discovered at Palos, Spain, contain interesting information on the cost of discovering America by Columbus. The sum total for which America was discovered amounted to $7,000, or 38,000 pesetas. This was distributed as follows: 14,000 pesetas for armament; 2,000 pesetas for personal expenses of Columbus and his officers and crew; 22,000 for general expenses during the eight months for which the voyage lasted. The sum of $7,000 in 1492 represented $70,000 in 1912.

Mikkelsen Heard From.—A most amazing tale of hardship endured in the polar regions is that of Capt. Mikkelsen published in the New York *Times*. He suffered from the very beginning. Abysses, storms, lack of food, scurvy, all imaginable obstacles to polar exploration he encountered. Only the briefest details have been received outside of the news of the safe return of the men. Capt. Mikkelsen and his companions reached Denmark Firth on May 20th, 1910. There they found the records left by Erichsen. They began their return journey nine days later and encountered terrible hardships. They reached Shannon Island. They had abandoned all hope of their rescue when they were picked up by a Norwegian fishing vessel on July 17th last and brought back to Aalsund.

The Alaskan Reindeer Herds.—During the ten years, 1892-1902, the U. S. Bureau of Education introduced 1,280 European reindeer into Alaska, where the natives were threatened with starvation owing to the destruction of the once abundant American reindeer, or caribou. It was also expected that these animals would serve the many useful purposes in the domestic economy of the Alaskans for which they have been so highly prized in northern Europe and Asia. The success of the undertaking has been remarkable. A recent official report on the subject states that these herds, which are under the care of the teachers at the government schools, now number 33,629 head, and they are increasing rapidly. Their meat is in great demand by both whites and natives, and their skins supply the best winter clothing. It is expected that the exportation of reindeer meat will soon become an important industry. Above all, the reindeer has proved a most efficient civilizing agency. The success of the Alaskan reindeer enterprise induced Dr. Wilfred Grenfell, in 1908, to import 300 reindeer from Lapland into Labrador, where they have now increased to about 1,200, and are a great boon to the natives. Last year the Canadian government bought 50 of Dr. Grenfell's herd for introduction into northern Canada.

Observation of Solar and Lunar Halos in France.—The most complete descriptive account of all known forms of solar and lunar halos is that published last year by Louis Besson in *L'Astronomie*, the organ of the Astronomical Society of France. The principal purpose of M. Besson's memoir was to call attention to the urgent need of accurate and systematic observations of these interesting phenomena, many of which have so rarely been seen and described by trained observers that the data needed for their theoretical discussion are decidedly fragmentary at present. This suggestion has met with a hearty response on the part of French meteorologists and astronomers, and every number of *L'Astronomie* now contains reports and descriptions of halos; often accompanied by drawings, and sometimes by photographs. Several rare forms have already been reported. In only one other country, viz., Holland, is there a large and active corps of halo observers. Their observations have been published annually by the Meteorological Institute of the Netherlands and have greatly enriched the branch of science dealing with this generally neglected subject. The history of halo-observing the world over has been remarkable in the fact that in the days of our grandfathers these phenomena were much more generally watched for and more widely known to scientific men than they are to-day. A revival in the study of halos is an urgent desideratum, especially in English-speaking countries. As halos are especially common in the polar regions it is desirable that polar explorers should acquaint themselves with the detailed literature of the subject (all of which is in French and German) before they embark upon their travels.

Aeronautics

The Military Breguet Biplane.—The new military biplane designed by Breguet is a remarkable machine in every way. The power plant is mounted in front as in most monoplanes. A 14-cylinder 100 horse-power Gnome engine drives two two-bladed propellers through reducing gear. Only four very stout vertical struts are employed between the planes. The body is of torpedo shape and is constructed of steel tubing, steel girders and ash. Wood plays but very little part in the construction of the machine. The machine can be completely folded in five minutes.

The National Balloon Contest.—On July 28th seven balloons rose from Kansas City, Mo., in the National Elimination Race. The winner was the balloon "Uncle Sam," piloted by Capt. H. D. Honeywell, Roy F. Donaldson, aid, entered by the Kansas City Aero Club. The distance covered was about 925 miles, the balloon landing on the historic battle ground of Bull Run. The second in the race was the "Kansas City II," piloted by John Watts, George Quisenberry, aid, entered by the Indianapolis Aero Club. The distance covered was about 640 miles. The third in the race was the balloon "Drifter," piloted by Albert Holtz, Charles Trautman, aid, entered by the Cincinnati Aero Club. The distance covered was about 425 miles.

Requirements for Naval Aeroplanes.—On the 25th ult. specifications for hydro-aeroplanes, with which, by another year, it is hoped to have every battleship equipped, were issued. Constructors are requested to inform the Navy Department by August 15th if they intend building machines to fulfill the requirements, and to state when such machines will be ready. They are required to carry, as a full load, two persons of a combined weight of 350 pounds, together with a wireless outfit and other instruments and supplies for a 4-hour flight. A maximum speed of 55 miles per hour must be shown as an average of ten flights—five with the wind and five against it—over a mile course, and 50 miles per hour throughout the 4-hour endurance test with full load. The latter test will be made over a 5-mile triangular course, the speed being determined by a recording anemometer. All machines must rise from the water in still air, with a run of not over 1,000 feet; must climb to 1,500 feet in one or more big spirals and in a given time (not yet determined) must turn without skidding, stalling or sliding, in a circle of 200 yards radius, and must glide from a height of 500 feet with power off a distance of 2,500 feet in a horizontal direction. Air-cooled motors are preferred and an extra premium will probably be offered for a heavy-oil motor or one using kerosene or alcohol. It must be arranged to be started from the seat by the pilot. The machines must be able to be hoisted on board ship intact and to be quickly disassembled. The hydroplane floats must have watertight compartments and means of draining readily. The aeroplane must be able to remain upright on the surface of the sea in a 20-mile wind when the motor is stopped.

A Woman's Opinion of Aviation.—Mrs. Elizabeth Hiatt Gregory, a woman writer who specializes on aeronautics, gave a lecture before the Aeronautical Society of New York on "Woman's Part in Aviation." It was the opinion of Mrs. Gregory that flying is an unsuitable occupation for women, and under no circumstances should she be allowed to use an aeroplane, since its safety is mostly a matter of gamble. Instead of relying upon an instrument, the aviator trusts principally to his own watchfulness, which obviously leaves the margin of danger very great, as there are many accidents due to uncontrollable error on the part of the machine or tricks of the wind. Mrs. Gregory stated that aviators put too much stress on their ability to ward off accidents by this watchfulness. As an example she referred to the late Miss Harriet Quimby, whose very first accident resulted in her death. "A few days before her death," said Mrs. Gregory, "Miss Quimby told me that driving an aeroplane was as safe as riding in an automobile, as long as one was careful. She had tried both. She thought mishaps with few exceptions came to those who attempted foolhardy feats. She claimed that in driving an automobile the driver has sudden starts and stops, twists and turns through the crowded thoroughfares; while the air-pilot must constantly be on the lookout for cross-currents and pockets that may upset his craft." Miss Quimby thought women were as well fitted for handling an aeroplane as men. It was merely a matter of personality, she maintained. The lecture was illustrated with lantern slides, showing both the American and foreign women of the air. Pictures of men fliers in spectacular feats were also thrown on the screen. Mrs. Gregory said that while only twelve women in the world have been granted pilots' licenses, there have been five deaths. Three of these have been American women. The first was Miss Denise Moore, an American girl, who while completing her tests for a license at the Farman School in Paris, had her fatal fall. The other two were Miss Harriet Quimby and Mrs. Julia Clark. Both Miss Quimby and Mrs. Clark had made their qualifying tests.

The Cream Separator

Its Development, Advantages and Unsolved Problems

The parts of a revolving bowl fastening nut, shell, liner and feed tube

FIFTEEN years ago the creameries of this country still followed the custom of maintaining cream routes, from which the hand-skimmed cream was collected from three to six times a week. A few years later these routes were a thing of the past. Instead, separator stations were maintained at centrally located points, to which the farmer could bring his milk, have it separated in a few minutes, and return with his skim milk and receipt for his cream. But now another change has come over the industry, and instead of taking his milk to one of the numerous separator stations, each farmer separates his milk on his own farm and in his own separator, and once or twice a week, when he goes to town to deliver eggs and to buy provisions, he takes along the cream. The one great factor in these revolutionary changes in a great industry is the centrifugal separator, and it is the purpose here to trace very briefly the growth and development of the separator, to point out its advantages, and to discuss some of the problems still unsolved.

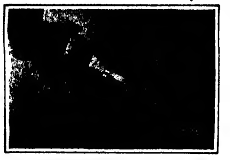
Your milk, homogeneous when bottled at the dairy, will be found in two fairly well defined layers when you bring it in from the doorstep early in the morning. A few hours later, the line of separation will be found at a lower level. The separation is due not to one cause, but to several, but the most important single cause, and the one which determines the relative positions of the layers, is the fact that the particles of the lower watery layer are heavier, or rather have greater mass, than the particles of the upper or oily layer. The older methods of separation all depended on the force of gravity acting to separate the two component parts of the milk, and all improvements were directed to modifying other conditions. It is a well known fact that the relative viscosity of the two constituents influences the rapidity of separation, and the relative viscosity can readily be modified through certain changes in temperature. Both the shallow pan method and the deep can method depended for their efficiency on a favorable adjustment of viscosities. The water dilution method was only another step in the same direction, but although all of these methods were in use for many centuries, no appreciable advance was made in the industry.

The mass of a body cannot be changed. Its weight, or apparent mass, can however be changed by putting the body in motion. A very simple experiment will prove this. If a rapidly descending elevator comes to an abrupt stop, the sensations of the passenger will be convincing. A small weight on a spring balance suspended in the elevator would give the exact measure of this apparent increase in mass. The spring balance may also be used in another way to demonstrate the same truth. Secure a weight to the balance, and swing it at arm's length as you would a sling. While in motion, the pointer indicates a greater mass than when at rest. The mass remains the same, but apparently it increases, and in this case, the force which produces this result is known as centrifugal force. This force is similar in effect to that of the force of gravity, but within wide limits it can be increased at will.

A liquid composed of two liquids of different densities, as an emulsion of oil and water, remains stable only by virtue of the attraction of the particles for one another, which varies with the different liquids. In the case of oil and water, this attraction is very small, and to break up such an emulsion it is necessary only to apply a force which will overcome the attraction between the particles of oil and the particles of water. Gravity alone will do it by acting more powerfully on the water than on the oil. If the force of gravity would be multiplied say by ten, then the weights would be multiplied by ten and the difference between the weights would be correspondingly increased. This would mean that while the force which tends to hold the particles together remains the same, the force which tends to pull them apart is increased ten fold. The result would be a more rapid and a more thorough separation. The force of gravity, however, cannot be increased, but in the centrifugal machine we have a force which will accomplish the same result.

Throughout its development, the history of the cream separator is inextricably bound up with progress in a number of other arts. The high speeds necessary for efficiency were made possible only by many improvements in journal boxes and frictionless bearings. Then, too, the development of the separator had to wait on the development of steel—an extremely hard steel for the bearings and an extremely tough steel for the bowl. It must be remembered that the pressure generated within that thin wall of steel is as great if not greater than the pressure in a locomotive boiler. But we shall confine ourselves here to the development of the centrifugal machine for separating out the cream from milk.

Tool for holding together the disks of a liner while washing them. By the use of the tool the disks may be washed as a single piece.



Method of transferring the disks of the skimming device upon the tool preparatory to washing or of replacing the disks on the liner.

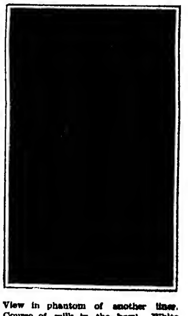
The first application was made about 1860, in Germany, with a glass tube swung rapidly about a center, to determine the richness of milk samples. The modern Babcock tester is identical in principle. It consists of a vertical spindle with radial horizontal arms on which graduated glass tubes containing milk samples are suspended. By rotating the spindle through its gearing, the tubes assume a horizontal position. The first attempts at separating cream from milk in larger quantities were made with a similar apparatus, pails being used instead of glass tubes. Then followed the single closed pail, centered in an upright position on a vertical spindle. The rapid rotation caused the milk to assume the form of a wall at the periphery of the pail, and when the machine was stopped, the two layers which had been vertical became horizontal, with the cream on top. All of these devices necessitated hand skimming after separation of the milk into layers. Such was the state of the art after twenty years of development, when in 1880 Houston and Thompson obtained a patent on a self-skimming separator which was continuous in operation. This machine was faulty in practice, but it marked an epoch in cream separator history because it pointed the way to other inventors, who quickly solved the mechanical problems involved in the working out of a successful separator of this type.

Sectional view, showing course of the milk entering a bowl and the paths of the skim milk and cream during and after separation.

The next great step was the invention of the liner, patented by Baron von Bechtolsheim in 1890. This consists of a number of division contrivances in the bowl, dividing the milk into thin layers, and intersecting the radial path of the milk in its passage toward the periphery. Separators up to that time had all been of the hollow bowl type. In nearly all, the milk was fed in through a central tube to the bottom of the bowl and the skimming was done at or near the top. The milk thus was caused to flow outwardly from the center and upwardly along the wall. The liner, however, broke up the milk into thin layers while under the influence of centrifugal force, and thus avoided the eddy currents which would tend to form in a hollow bowl. Before von Bechtolsheim's invention various division contrivances were already in use, but none of these were based on the liner principle. Baffle plates were well known. Their function was merely to compel the body of milk to partake of the motion of the bowl, since its inertia would otherwise cause it to travel at a slower speed. Thin horizontal plates, to obstruct the milk in its upward path, had also been in use. Dr. Gustaf de Laval,

(Continued on page 124.)

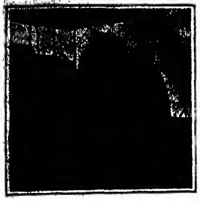
View in phantom of a de Laval disk liner structure in position on the spindle. The whole milk is fed through the hollow spindle *T* and emerges between the disks, through the openings in the wings *W*.



View in phantom of another liner. Course of milk in the bowl. White pointed arrows indicate whole milk, all white arrows show cream; black pointed arrows partially separated milk.

A general view of a separator with part of the machine shown in section in order to reveal the very simple gearing, the system of lubricating and the inner construction of the center balanced wheel.

A view showing a complete hand separator having a capacity of four hundred and twenty-five pounds of milk per hour. The machine measures forty-six and a half inches in height to the top of the can.



The International Motor Contest at Winnipeg

An Annual Traction Engine Contest that Means Much to Farmers and Manufacturers

By L. W. Ellis

THE great annual Motor Contest at Winnipeg is over and the addition of four great tables of definite information to that already brought out on the farm tractor, is a notable event in the technical world. Competition this year was keener, if anything, than ever before, and although some of the contestants in earlier meetings dropped out, the newer ones who took their places showed that they were rapidly overtaking the former leaders in efficiency.

The Winnipeg Motor Contest can hardly be said to have that diversity of interest that marks the contests in France, because under the conditions named there is little encouragement for the appearance of such a variety of types as were seen at Chelles last March. The American farm tractor has become practically standard in so far as the method of attaching the plows or cultivating instruments is concerned. The direct traction method prevails, and all of the tractors seen in the contest at Winnipeg were those having separate plows attached by chains to a drawbar at the rear of the engine.

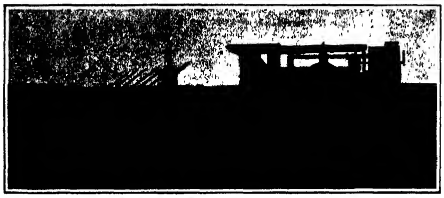
This does not mean that the Winnipeg Competition has not brought out new types of machinery. Indeed, it is the one big event of the year, where the fond inventor or builder proudly brings forth his creation to find out how it compares with those of established reputation. Sometimes the new comers give a remarkably good account of themselves, and frequently all "dope" is upset by truly remarkable performances of some new machine. Last year the four-cylinder Aultman-Taylor gasoline tractor, which many, even of the technical visitors, saw for the first time at the Contest, gave the gold medal winner a close run, and this year two tractors of the same general type won, respectively, a gold medal in the class for larger gasoline engines, and a silver medal in the class for larger kerosene engines. The J. I. Case Threshing Machine Company appeared on the market this year for the first time with a gasoline tractor in addition to their regular steam engine line and with the smaller type won a gold medal in competition with several makes which have been represented in previous competitions.

The Holt-Caterpillar, a machine very similar in appearance to the Lefebre tractor pictured in the SCIENTIFIC AMERICAN SUPPLEMENT, June 29th, made a notable record in plowing after a less fortunate brake test. It demonstrated the efficiency of the peculiar type of traction wheel and would have received a silver medal in the larger gasoline class but for a penalty of 29 points for failure to be ready on the brake test—a failure due to the shortcoming of an expert who was intrusted with the preliminary work of getting ready for the Contest.

A four-wheel-drive tractor, made by Heer Engine Company, demonstrated great tractive efficiency in various ways, but unfortunately met with an accident to one of its drive chains while assisting a competitor out of a mud hole in the prairie, and was somewhat handicapped in the Contest. The American Gas Tractor was also a new comer and showed up very nicely as to construction and power, although scored quite low for a high fuel consumption, which should disappear with further refinement.

Among the older competitors the J. I. Case Company had things practically its own way in the steam engine classes, having the only engine in each of the two smaller classes and a comparatively easy victory over the Sawyer-Massey Company in the class for the largest engines. The latter company was unfortunate enough to meet with a minor accident shortly after the start in the plowing test, and it was necessary to draw fires until a new blow-off cock could be put in place. The Case Company was awarded the gold medal and two diplomas.

A Case steamer taking water on the run.

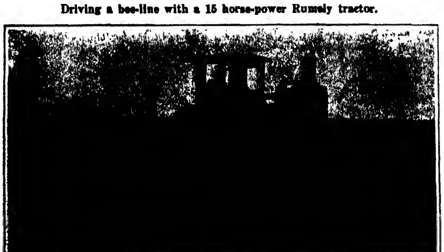


I. H. C. Mogul 45, pulling eight plows in class B, and winning a bronze medal.

The line-up before the start.

The American gas tractor in the foreground; the Rumely 15 horse-power oil tractor at the left; and the International Mogul in the distance.

Driving a bee-line with a 15 horse-power Rumely tractor.



The J. I. Case gold medal winner in class B. Drawing five plows.

None of the other large steam engine concerns such as Reeves, Avery, Rumely, Nichols & Shepard, or The Russell & Co., entered the steam engine classes, although competing strongly in the market. There is a tendency to belittle the steam engine trade of the present because of the overshadowing number of internal-combustion tractors brought forth in these competitions. However, steam tractor firms are all apparently building as many engines as before, and some have greatly increased their business, even in the face of the strong gas tractor competition of the last few years.

The International Harvester Company, the Avery Company and M. Rumely Company have been consistent performers in these competitions for a number of years. This year the International engines won a gold medal in the smaller kerosene class and a silver medal in the smaller kerosene class; a silver medal in the larger gasoline class, and a bronze medal in the larger kerosene class, having had five entries in competition. The tractor, made by M. Rumely Company, won easily in the larger kerosene class and scored the highest number of points given to any tractor in the entire contest. The smaller Rumely tractor, with a motor somewhat different in design from the standard type, secured a silver medal in its class, though scored low on fuel consumption. The Avery Company secured two bronze medals, one on kerosene and one on gasoline, using the same type of engine in both cases.

Canada was not well represented in the contest although Goold, Shapley & Muir, of Brantford, won the silver medal in the smaller gasoline engine class, and Sawyer-Massey received a silver medal in the steam engine class. The greatest competition came in the class for the larger sizes of gasoline engines, and the number of large engines in the contest indicates that there is no likelihood of their being discontinued at an early date in favor of smaller tractors.

The entire motor competition was carried out in practically the manner described in the SCIENTIFIC AMERICAN, June 29th. The exhibition officials had provided this year a new testing shed, with two new friction brakes securely anchored to beds of concrete. With this and other new equipment, the brake tests were run off without delay. The two-hour economy tests showed a vast improvement in the fuel efficiency of the leading engines. Little criticism can be made regarding the handling of the economy brake tests, as all apparatus were so arranged that spectators could keep close check on all readings as to fuel and load, and there was little possibility of error

A half-hour maximum test was given each engine, the idea being to ascertain the highest amount of power that could be turned out continuously without causing the engine to show distress. Points were given on the steadiness of running, the condition of the engine, and for the excess of horse-power developed in the maximum test over what was developed in the

(Continued on page 124)

A Plan for Converting the Sahara Desert Into a Sea

What Would Happen if the French Flooded the Great Desert

By G. A. Thompson

A SENSATION was recently caused in Paris by the daring proposal of Prof. Etchegoyen, a distinguished scientist, who declares that France ought to lose no time in converting the vast desert of Sahara into an inland sea. He claims that, since "about a quarter of the whole desert area lies below sea level, the construction of a canal some fifty miles long through the higher land of the north African coast would immediately create a Sahara Sea equal in size to about half the extent of the Mediterranean." This canal, he states, would present no great mechanical difficulties because the coast land is composed of sand and soft rock formations.

The consequences of such engineering, he declares, would be gigantic. All the arid regions now surrounding the desert and those parts of the Sahara which are above the level of the ocean would be rendered as fertile as Europe, since the present sterile condition is due to no fault of the soil but is caused solely by lack of water. Millions of human beings could then support themselves in comfort, who now lead a miserable existence on the verge of starvation. Moreover, a great new colony could be added to the possessions of France, of which the political and economic importance can hardly be overestimated. A fleet of steamers would navigate the Sea of Sahara, the depth of which would vary from ten to sixty fathoms, and produce a flourishing traffic between Algeria and French West Africa. And the most remarkable result of all would be the alteration of the climate of all northern Africa from equatorial extremes of heat to the pleasing temperature of Natal, thus enhancing its value as a place of colonization for Europeans.

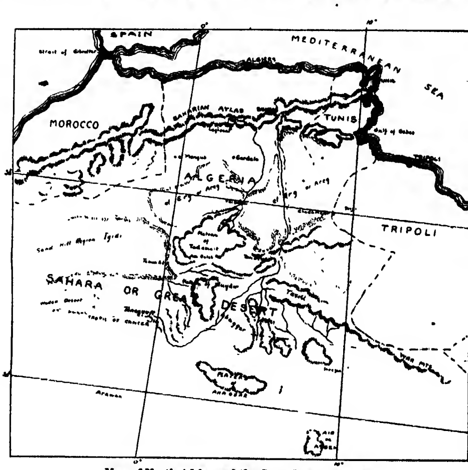
Prof. Etchegoyen's scheme is provoking much comment, and objections are not wanting. Certain meteorological experts cry out in horror that any tampering with weather conditions in Africa would transform the climate of Europe; that, if tropical Africa should become temperate, Europe would become arctic, and an alarming picture is drawn of England, Belgium, and Denmark lying under several feet of perpetual snow, and their inhabitants either emigrating in haste to milder countries or leading thenceforth the lives of Eskimos. A still more striking reason for leaving the great desert alone is presented in the argument that, by the displacement of so many billions of tons of water, the equilibrium of the earth would actually be affected, and that the engineer who had undertaken the task of adding a new sea to the map of the world would forever afterward be cursed by humanity for having altered the axis of the globe.

On the other hand, various savants consider that these objections are illusory; that the possibilities prophesied are much exaggerated. These men are rejoicing in "another magnificent idea originated in that country which conceived the Suez and Panama canals." The time is near at hand, they claim with enthusiasm, when "the parched ground shall become a pool" and "the desert shall blossom as the rose," as foretold by the Hebrew seer centuries ago.

Considering the broad interest and influence to be established by the undertaking of such a scheme, and the remarkable confliction of opinion concerning its effect, some popular statement of Saharan conditions is apropos at this time. The frigid zones and the "Highlands of the World" have occupied so much of the public attention during the past few years that only the vaguest thought has wandered toward this "last of the unexplored places." As a matter of fact, however, there is no more interesting region on the earth than the great desert of Africa, nor one about which so little is generally known, nor concerning which so many fascinating myths are told and believed. Since the earliest records of history it has been a place of sublime mystery, of dread and weird terrors, of strange and impossible happenings. From the pyramids all the way across the continent to the Atlantic Ocean it reaches—and what is it like, what fearful secrets does it hide? In reality, the Sahara is not so fearful as it is grand and wonderful, as the ocean is wonderful, or any other expression of nature on a gigantic scale, and like the ocean it can be tamed to the service of mankind if approached in proper fashion.

Notwithstanding the fact that the desert has been traversed from time immemorial by native tribes carrying fruits and silks and costly woods and ivory for barter from center to coast settlements, and still is crossed at certain points by important caravan routes, it is even to-day almost entirely unexplored by civilized men. Sir Lambert Playfair, Dr. Erwin von Bary, De Lenz and a few others have partially explored certain portions of it during the past twenty-nine years, yet there still remain large tracts of the territory that have never been viewed by the eyes of any white man.

Topographically, almost the whole northern half of Africa is a desert, in which Egypt and fertile mountainous tracts along the Mediterranean may be regarded as large oases. Geographically, there are three deserts—the Nubian, bordering the Red Sea and reappearing across the sea in Asia in the Arabian Desert, the Libyan, between Fezzan and Egypt, and Sahara or the Great Desert, which includes a number of small arid tracts that extend like long arms far into the fertile regions north and south of its principal body. The last presents a vast undivided waste almost two thousand miles in length from east to west, and nearly one thousand in average breadth from north to south. This means an approximate area of 3,595,500 square miles, one equal to the whole of Europe, without the Scandinavian peninsula. Politically, the Sahara belongs to the various countries which border it or which exercise a protectorate over lands that lie near. Hence, Morocco, the Turkish Empire, Italy, and, through Algeria and Tunis, France, own each its neighboring portion; but by far the chief part of the territory belongs to France along with the French Kongo and the colony on the Senegal.



Map of North Africa and the Great Desert, showing the topography that would shape the Sahara Sea.

The Sahara Desert has several very curious features. The most remarkable is, perhaps, its distinctness of boundary. Standing on the southern slope of the Atlas range, one looks out upon what has almost the appearance of a boundless sea, which forms, as it were, a bold coastline along its northern edge, whose sheltered bays and commanding promontories are occupied by a series of towns and villages. Toward the south, as in Morocco and Algeria, the desert comes to a close in some localities as suddenly as if it had been cut off with a knife, in others it merges gradually into the well-watered and fertile lands of the Soudan. This sea-like aspect of certain portions of the Sahara has given rise to much popular misconception as to its general appearance, and has even affected the ideas and phraseology of some scientific writers. It is not at all the low sand-plain that it is widely supposed to be. It is rather a region of the most varied surface and irregular relief. Rugged hills of barren, rocky formation, known as *hammada*, plateaus of firm clay, mighty fields of loose stones and water-worn pebbles, shallow basins filled with very salt water, and arid steppes covered with sage brush are interspersed with the famous sand-dunes which give character to this remarkable region. Those terrible expanses of shifting sand so fine that it actually penetrates the skin of the traveler and makes breathing distressful lie chiefly toward the east, in the Eastern Erg, as it is called. In the Libyan Desert there are such expanses of vast and unknown limit. In the Western Erg from the Atlantic coast to south of Cape Blanco a broad belt of dunes called Igidi or Gidi—from the Berber word for *dunes*—extends thirteen hundred miles northeast with a breadth of from fifty to three hundred miles.

This is the region which from the highlands of Algeria and Morocco looks so much like a storm-tossed sea. The dunes in all parts of the Sahara lie generally in long undulating lines, very like the billows of the ocean, with gradual slopes to windward and an abrupt descent leeward. They are usually sixty to seventy feet in height, but are said to attain in some places fully three hundred feet. The sand that forms them is exceedingly fine, being, in fact, the dust of rock battered and powdered by the action of centuries of fierce winds and rainless heat by day and sharp chill by night. In this condition every slightest breeze is sufficient to raise it in choking clouds, though the amazing reports of frightful sand-storms which overwhelm whole caravans being the common thing in the desert are mere fairy tales. Under the influence of the winds, all the dunes are subject to a certain amount of continual change, of course, but their equilibrium is such that in topographic distribution they are comparatively permanent. Some of them even have names of their own, like the Gern (peak) al-Shief and Gern Abd-al-Kader to the south of Golea in Algeria.

The color of the sand dunes *en masse* is a rich golden hue, which glints and gleams in the glare of the sunlight with a dazzling strength. Each individual grain is reddish-yellow from the presence of iron, and generally crystalline from having once formed a part of soft quartz rock. Gneiss and mica schists, granite, limestone, slates and basalt all appear in the rocky formation of the Sahara, but the relative proportion of their distribution is not yet fully known. In the central part of the desert south of Algeria there are large extents of red sandstone formations, whose dust carried seaward by the winds is said to produce the peculiar red sky effects noticed sometimes over certain parts of the Atlantic, and notably over Algeria, whither artists journey from every quarter of the earth to study and copy the marvelous combination of rich crimsons and purples and amber. Such sand—produced by the fracturing and crumbling of the cliffs through alternate daily heat and rapid radiation at night—is an active agent of the winds in abrading. In many places it has planed the flat rocks of the *hammada* as smooth as ice. Elsewhere it has scored the vertical faces of the cliffs with curious imitations of glacial striation and has helped to undercut the pillars or table-like eminences which, under the name of *gurs* or "witnesses," are among the most familiar products of Saharan erosion.

As to the elevation of the Sahara, some responsible general estimates have been made within the past few years. The Upper Sahara consists of a rocky plateau, never less than thirteen hundred feet high, which rises at times in considerable peaks; the lower, to which the plateau descends by a steep slope, is a vast depression of clay and sand, usually from two to three hundred feet above sea-level. Scientific investigation of the desert has shown that the soil there lacks no element

(*Continued on page [illegible].*)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Information on Plumbing.

To the Editor of the SCIENTIFIC AMERICAN:

"A Plumbing Improvement Wanted," page 113, issue of February 3rd, 1912. Please inform "master plumber" that he should make a globe of thin copper, then cover with India rubber for the valves. These would float all right and resist external pressure, and the outer covering of India rubber would make the water-tight joint when required.

JOHN WM. MCBEATH,
Fellow Chemical Society.

Kimberley, Cape Colony, Africa.

The Laxey Waterwheel

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 19th, page 356, referring to the Laxey waterwheel, you state that it was built about 1865.

I went to the Isle of Man in June, 1859, and went to Laxey in September to visit the lead mines there, and at that time the great wheel had been at work some few years; how many, I cannot now remember, after such a long lapse of years. The above date is the more fixed in my memory, as I was then a boy of eighteen, and this journey to the Isle of Man was my first job.

THOMAS J. WOOD.

Itajubá, Minas Geraes, Brazil.

Restraining the Floods

To the Editor of the SCIENTIFIC AMERICAN:

I have been a subscriber many years. Just finished your article on the Mississippi River (May 25th, page 475). You have a very good illustration for a levee.

The writer piloted on the Mississippi River and the Illinois River fourteen years. Lived in Cairo, Ill., forty years. Was mayor of that city from 1895 to 1897. In 1898 took a trip through Europe. Noticed in Germany the farms were ditched in zigzag fashion; ditches from eight to ten feet wide and about same depth; many miles across the country. They plant willows all along the banks of the ditches. The young sprouts are made into trunks and baskets, which is a very large industry.

These ditches really form a grand system of irrigation. The crops looked fine—healthy and abundant. Water runs along slowly, avoiding the rush of the water into creeks, and rivers have water all summer. In our country we dig straight ditches, which produce overflows during spring freshets, that increase each year as the lowlands are opened up for cultivation. I can remember rises at Cairo, Ill., with high-water marks of 45, 47, 52 feet, and this year 54 feet from low-water mark, a steady increase each flood year.

When you think of making levees in the years to come, I doubt if the States or Government combined can build levees of sufficient height to protect the Southern States, without bankrupting the States and the Government; and with the best of levees there is a continual danger of breaking some of them.

Lockport, N. Y. C. R. WOODWARD.

The Wireless Meddler Again

To the Editor of the SCIENTIFIC AMERICAN:

While the question of amateur interference on the Atlantic coast is under discussion in your correspondence columns, I feel that it might not be amiss for me to add what information I can as to the situation on the Pacific coast.

Amateur stations are as plentiful in the neighborhood of San Francisco Bay as anywhere in the country, and I cannot but feel that the conditions here are a fair example of what is to be met in any part of the country.

I had the good fortune to be listening in at the time of two separate distress messages from vessels here. On the first occasion, the steamer "Beaver" had rammed the Norwegian tramp "Selja" and barely succeeded in rescuing her crew before she sank. The "Beaver" herself was badly damaged, so that the captain felt it prudent to call for aid. At the first S.O.S., nearly every station, amateur and professional, within receiving distance started to answer, but within three minutes of the first call for help, the United Wireless station at San Francisco had a clear line, and was exchanging messages as fast as the apparatus could be worked. Amateurs who started to work during the distress messages were so promptly silenced by other amateurs in their neighborhood that the interference from this source was almost negligible. The main interference came from other commercial stations, who were ignorant of the nature of the business being transacted at the time. Interference was also caused by both stations of a wireless telephone company in the locality, who refused to stop operating until called upon several times to do so. To my mind, the first restrictions to be placed upon wireless work of any kind should fall upon these wireless telephone companies, since the range of disturbance that they create is far greater than that of the average amateur.

The other distress message which I happened to hear was from the steamer "Queen," which had caught fire in the foreward hold. The messages in this case were given religious consideration by all amateurs.

Either the navy stations on this coast differ widely from those on the Atlantic, or somebody is mistaken when they claim that apparatus in such places is antiquated. I know of no better apparatus than the Telefunken sets now being installed at the Government stations. And as for operators, the average Government man, on this coast, at least, can rank with the best in the world. In any station, however, local interference may at times prevent the reception of messages clearly audible at some other nearby station. I think this will explain Mr. Powell's statement in regard to this matter.

Legislation on this subject should only be undertaken with a full knowledge of existing conditions, and of how to better them, and petitions signed by those entirely ignorant of the situation should not be granted any weight in deciding this matter.

Berkeley, Cal. FRANK RIEBER.

High Speed Through the Ice Fields

To the Editor of the SCIENTIFIC AMERICAN:

The editorial upon this subject in your number for July 6th, with its conclusion that high speeds will probably be maintained in the future, raised a line of thought in my mind which I have not seen heretofore discussed. The iceberg which was fatal to the "Titanic" was, I believe, discovered by her lookout about 30 seconds before she struck it. The "Titanic" was traveling at a speed of 22 knots, and the berg was, therefore, originally seen at a distance of 1,100 feet.

Let us first assume, what is approximately the fact, that the radius of curvature of a vessel's track, when her rudder is turned, is the same at all reasonable speeds. Then if the rudder of the "Titanic" had been instantaneously turned, it would have made no difference at what speed she was going, she would have followed precisely the same course, although the amount of damage inflicted would naturally have differed somewhat with the speed of collision. If at less speed the radius of curvature were somewhat larger than at high, which is really the case, the berg could have been more surely avoided at the higher speed.

The point which I wish to raise, however, is that the rudder could not possibly have been instantaneously turned. After the lookout first glimpsed the berg through the darkness, it took him an appreciable time, let us say 5 seconds, to make up his mind that it really was a berg, and to shout to the officer on the bridge. To attract the officer's attention, for him to receive the information, and to step to the engineer's signal, required let us say 5 more seconds. To call the engineer's attention, and to transmit the signal to change the course of the ship required, let us say 5 seconds. To turn the lever and shift the rudder by the required amount required, let us say, 5 more seconds; 20 seconds in all, out of the possible 30. Some of these estimates may be too large, and some too small, but the total 20 seconds cannot be very far out of the way. The ship, therefore, had 10 seconds left, after the rudder was completely turned, in which to change her course.

If now she had been going at half speed the berg would still have been sighted at 1,100 feet distance, but it would have taken the ship 60 seconds to reach it, and the vessel would have had 40 seconds in which to make the turn to avoid it. When she first began to turn she would then have been twice as far from the berg, and since for small arcs the deviation, 1—*cos*, varies as the square of the arc, had she followed the same radius of curvature, at the end of the 1,100 feet she would have been four times farther from her original course than if she had gone at full speed. Even if the radius of curvature of her course were twice as great, she would still have been twice as far from her original course. This would certainly have saved the ship.

Mr. Ismay's point that the higher the speed the less the danger, because the ship would the sooner be through the danger zone, does not appear tenable to the writer. As applied to fog there is undoubtedly an element of truth in it, because one of the dangers of fog is that of being run down by other fast boats. The longer you stay in a foggy region the more boats will cross your track. A slow boat should get through a fog just as quickly as she can. With ice this is not the case, since the speed of the ice compared to that of the ship is so small as to be practically negligible. We may consider it merely as so many islands. All the danger depends on the ship herself. Consequently, the element of time does not enter at all, only distance. Whether she is but one hour or ten hours in the ice is equally dangerous, provided her course is the same.

In conclusion, I would like to add that while the large boat is undoubtedly more economical to run, more stable, more luxurious, and in some respects safer than the small one, yet when it is a question of either fog or ice, the smaller one has the distinct advantage that while the obstacle is visible from both ships at the same distance, the smaller one can in the same time, even if going at the same speed, change her course through a greater amount to avoid it, and is, therefore, in this respect the safer of the two. A smaller boat could undoubtedly have avoided this particular berg.

WILLIAM H. PICKERING.

Harvard Astronomical Station, Mandeville, Jamaica, W. I.

The Cause of the Quimby Accident

To the Editor of the SCIENTIFIC AMERICAN:

You will recall that in the July 20th issue you published my account of the Quimby accident. Underneath it you gave the substance of a conversation with Miss Quimby's mechanic.

In spite of the general misunderstanding on this Quimby accident, I believe there was never anything clearer. Let me furnish you some further evidence.

When I went in the boat to examine the wreck of Miss Quimby's machine I asked Capt Chase, acting chief signal officer of the United States Army, if he would accompany me, as he had been sent by the Government to pick up whatever he could at the aviation meet. He did so. As we were rowed out to the wreck he asked me whether I noticed that the machine had turned to the left and that Miss Quimby and Mr. Willard were not only thrown out, but to the right. I said that I had noticed this. Mind you, all of this occurred before we had seen the wrecked monoplane. In other words, we had both agreed that the machine turned to the left just as it plunged downward.

When we reached the wreck I scrambled on top of it, and the first thing I saw was the rudder wire caught over the lower end of the warping lever. The mechanic had come out in another boat, and he, too, climbed onto the wreck. I pointed out the caught wire to him, and he held up his finger, and said, how did I know that the wire was caught in the air? He went on further to say that he believed it had been caught after the machine struck the water or on the way down. I replied that of course that question could never be settled, but the fact that it was so caught proved defective design. He then, in the presence of myself, Capt. Chase, and Mr. Thorndike, who rowed Capt. Chase and myself out in his little boat, unhooked the wire from the lower end of the warping lever.

I cannot see how he could be so short-sighted as to say that he did not do this, or that the warping lever was not caught.

In my own defense I have written to Capt. Chase and Mr. Thorndike and asked them to give me an affidavit stating that the wire was caught as I indicated. I inclose copies of the affidavits.

If you examine my sketch, you will see that by the wire catching as indicated the rudder would be thrown to the left and the monoplane turned toward the left as it plunged downward. Does it not seem that it is something more than mere coincidence that both Capt. Chase and myself agreed before we knew anything about this caught control that the aeroplane turned to the left?

I have plenty of evidence to prove that the wire was caught as I say, and it seems to me that the circumstantial evidence goes to prove that it was caught in the air. However, there is one thing that is certain, and that is that the machine should not have been constructed so that the wire could have become caught under any circumstances whatever.

In justice to myself I would much appreciate it if you will publish this affidavit of Mr. Thorndike's with the statements which I have made in this letter regarding the fact that Capt. Chase and myself both agreed the monoplane turned to the left before we knew anything about the controls being caught.

The idea of Willard jumping out or falling out is all nonsense. As the tail of the machine went up and to the right he was thrown out twenty-five or thirty-five feet as a hundred witnesses will testify. The fact that he went much further than Miss Quimby is, of course, easily explained when one realizes that he sat nearer the tail than she did, and because he went so far it gave the idea that he jumped. Assuming he had wanted to jump from a monoplane moving seventy miles an hour, he could not have jumped twenty-five feet. With the wind resistance against his body it would have been about all he could do to flop over the side of the machine, but as it was he was thrown far up and out, while Miss Quimby went below him.

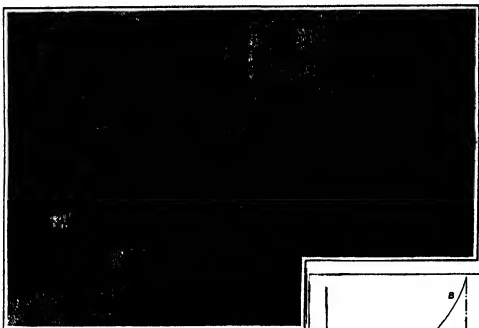
Newton Highlands, Mass. EARLE L. OVINGTON.

[The affidavits of Mr. Thorndike and Capt. Chase, referred to by Mr. Ovington, have been received. They agree with his account. Lack of space prevents our publishing them.—EDITOR.]

What is a Hydroplane?

The Evolution of a New Type of Craft

By Joseph B. Baker



A type of hydroplane without a sharp forefoot, and planing.

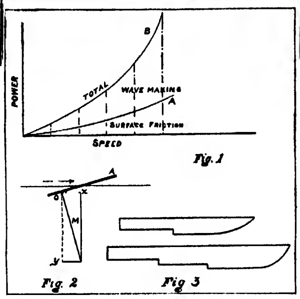
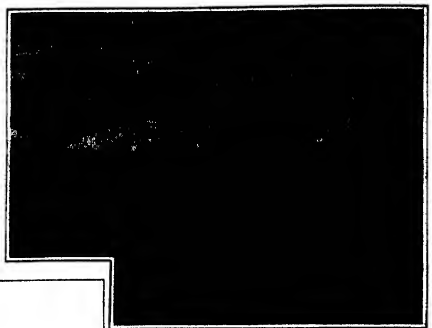


Fig 1.—Diagram indicating roughly how the power required to drive a boat rises with the speed, due to wave-making of immersed surface Fig 2.—Diagram showing the upward thrust due to motion of plane at an angle with the resisting medium Fig 3.—Single-step and two-step hydroplanes.



A type of hydroplane with a sharp forefoot, and planing.

THE attainment of high speed in water craft has been a fascinating problem ever since man began to venture upon the water. The oared vessels of the ancient maritime peoples, propelled by many galley-slaves laboring at banks of oars, the triremes in which the sea battles of the Greeks and Romans were fought, the speedy oar and sail ships of the Norse Vikings, the war canoes of the American Indians, were all pushed hard upon occasion, to get the utmost possible speed But these craft one and all were creatures of limitation; the boat, man's water-going invention, could not hope really to command the sea until steam became available for marine propulsion, replacing human muscle and the capricious aid of the wind by a mechanical power which could be increased indefinitely

The application of steam opened up a new era; but though vessel speeds were greatly increased, the ability to eat up the miles on the water as the railroad train does on land was by no means attained It might be thought that the speed of an engine-driven vessel would be merely a matter of motive power—that in order to increase the speed one must simply put in a larger, more powerful engine. But such is not the case, as the designers of steam craft in the first few decades following Robert Fulton's great demonstration soon found out So far from the speed of the vessel being proportional to the engine power, or in anything like that ratio, it was found that above a certain speed—depending on the design of the hull—it did little good to increase the power The work of the engine, delivered through side wheels, stern-wheel or propeller, was expended in urging the mass through the water on which it floated The ordinary boat is a structure which sinks till it has displaced a weight of water equal to its own weight, and in all boats this means that the immersed surface presents a considerable resistance to the forward urging of the wheels or propeller Shaping the surface to give the easiest possible passage through the water, by refinements of marine architecture based on the study of stream lines, fluid friction and the friction of the supporting fluid on the surfaces of the immersed part of the hull, reduces this retardation. But with the easiest sliding hull that could be built to give the required displacement consistent with seaworthiness, there is an inevitable limit to the increase of speed with increase of power—a limit beyond which it does not pay to put in a larger engine simply because at most a trifling increase of speed is obtained thereby. Any attempts to exceed this "critical speed" result in an abnormally heavy and bulky motive power and correspondingly great weight of fuel required to be carried and space alloted to fuel, a condition inimical to cargo carrying capacity and sometimes also to seaworthiness, and permissible only in war vessels and racing boats, where high speed at any cost is the ruling consideration.

The introduction of gas engines as motive power, giving rise to that remarkable product of the past fifteen years, the motor boat, helped the speed problem wonderfully by enabling a much larger power to be realized from a given weight and space of material in the engine and in the fuel carried (gasoline). Motor boats have set an entirely new standard of marine speeds through the use of an engine which is of small weight and size compared to the steam engine with its boiler and coal, and which allows the hull to be designed with finer lines. But notwithstanding the extension of the speed possibilities thus gained, the fluid resistance of the hull as an immersed surface largely remains to limit the speeds attainable. In brief: As long as the craft presents a considerable immersed surface it must be driven *through* the water, and, therefore, encounters a resistance which rises very rapidly with the speed. Without dwelling on technicalities we may note in passing that the fluid resistance to a boat's motion is made up of two parts, viz., surface friction and wave-making. As shown roughly in the annexed diagram (Fig. 1), whereas the surface friction (the lower ordinates) increases as the square of the speed, the power consumed in wave-making increases very much more rapidly, that is, at an increasingly rapid *rate* of increase. This wave-making resistance is due to the displacement of water by the moving boat.

But if one can avoid driving the craft through the water at all? If we can drive it *over* the water we can largely reduce the displacement resistance, which cuts such a figure in an immersed boat, and at the same time very considerably reduce the skin friction, making our curve of power consumption approximate curve *A* with short ordinates, since the immersed surface is much reduced. Then we shall be utilizing the principle which keeps a well-thrown "skipping-stone" flying for a long distance over the water, just as the aeroplane utilizes the principle which keeps a kite aloft.

The very consciousness of a need leads to its supply. The step from the ordinary boat to the hydroplane has been taken in response to the need of higher speed on the water, just as the step from the balloon to the aeroplane was taken in response to man's need of control and speed in the air. Both of these improvements have come from abandoning the supporting quality of mere volume displacement, and utilizing the supporting quality due to resistance to a plane driven at high speed. The hydroplane has a bottom structure which, though heavier than its displaced water, yet stays on the surface like a skipping-stone by constantly moving

"Elcoplane," the great rival of "Dixie Jr."

"Vita Jr.," the latest 1912 type. Note the front rudder.

on the water; the aeroplane is a heavier-than-air structure which stays up like a kite by continually moving against the air. The hydroplane is upheld because its velocity develops a sufficient upward thrust of the water over which it is passing, just as the aeroplane is upheld because its velocity develops a sufficient upward thrust of the air through which it is passing.

The hydroplane is a vessel designed for two features of performance: 1. To rise out of the water when driven, owing to a very strong upward thrust on its hull and a light total weight which the upper thrust can lift. 2. To offer the minimum friction resistance at speed. These features, in a craft having a powerful gasoline engine and manned by a competent crew, result in high speed. The hydroplane is driven faster than an ordinary boat, by an engine of given horse-power, because it is lifted up on top of the water and kept there; the power of the propeller exerted to drive the craft ahead also develops an upward thrust on the hull by reason of the plane bottom of the hull. Let us look more closely at this matter of upward thrust. Consider a heavy plank or plane, driven through the water in a direction making a slight angle with itself. The total resistance to the direction of motion may be resolved into components, one parallel to the plane and one normal to it. The former involves the skin friction; it is the latter which involves the levitating action of the plane. Let A, Fig. 2, represent the plane, and M this normal component which we may resolve into two components Ox, a horizontal drag tending to retard the motion of the plane, and Oy, a vertical lift on the plane. If now the speed of the plane is high enough in proportion to its weight, that is, if this component Oy is great enough to lift the weight of the plane, the latter will rise. The diagram shows that in order to obtain an advantage from the use of such a plane fixed on the bottom of a vessel, the benefit of the lift due to the plane must outweigh the drag and friction of the same—the latter diminishing, of course, as the craft rises on account of the diminution of immersed surface. It is all a matter of the ratio of the power of the craft to its weight. The idea itself is not new: plane boats equipped with powerful steam engines had been built before the present hydroplanes, but until the gasoline engine with its high weight efficiency was applied to motor boat propulsion, the weight of the power plant and of the hull required to contain the same was too great for the lifting force.[1] With the gasoline engine, itself of light weight for large power and capable of installation in a light hull having a bottom designed with one or more planes, the lifting energy was able to force the structure up out of the water; and the characteristic high speed of this craft at once resulted, owing to the reduction of wave-making and surface friction.

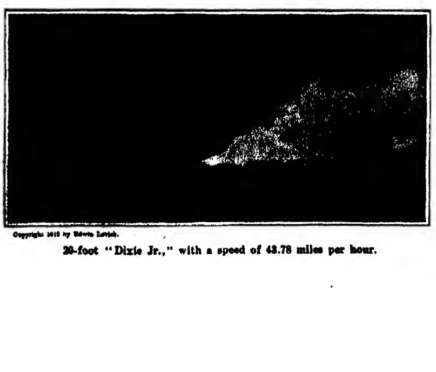
It is instructive to trace the performance of the hydroplane, its position with regard to the water as the speed is increased from zero to the maximum of which the vessel is capable. Take the simplest construction, the so-called monoplane (upper sketch, Fig. 3). At rest, this craft floats in the water like any other boat, being supported by its static buoyancy. When the engine is started, the resistance of the plane bottom causes the bow to rise; but ordinary buoyancy is still the ruling factor, and the stern sinks until the additional immersion of the after part displaces enough volume of water to support the boat. As the speed increases, the further rising of the bow moves the center of upward thrust back, until it reaches almost to the center of gravity of the craft. At this stage of the speed, since the point of support is very near the center of gravity, the boat is ready to pivot vertically, so to speak, upon this point; and with further increase of speed the boat, powerfully upheld by the vertical component of the fluid pressure on its bottom, drops its bow, but raises its stern, till its bottom rests on the surface of the water at a small angle therewith, and with very little displacement of water compared with that in the position of the boat when at rest. The main factor is no longer static buoyancy, but the new lifting force due to the speed of the boat. This is the planing position, the power of the engine is showing a speed which could never be attained in an ordinary boat with a displacement hull. If the speed is still further increased, the bow may be sharply depressed, causing the craft to dive headlong. The hydroplane may be built with a single plane or "step" or it may have two or more steps, as shown in Fig 3. These are over-water hydroplanes. A type in which the upward thrust is given by totally immersed planes has been successfully demonstrated by Mr. Peter Cooper Hewitt in this country and by Signor Enrico Forlanini abroad. It is to the over-water hydroplane that we owe the phenomenal advance in boat speeds in recent years. The 21 miles per hour of the "Vingt et un" ten years ago, a speed unheard of up to that time, has to-day been more than doubled, the "Dixie IV," the fastest boat in the world, making 46 miles. Attention to detail, refinement of design and the cutting down of weight enables this American-built craft of 500 horse-power to beat foreign boats having over 800 horse-power. The same speed qualities are shown in smaller boats of this type also; a craft new this year and only 20 feet long has shown a speed of 38 miles per hour.

The average of five runs in a speed trial of the 20-foot "Dixie, Jr.," hydroplane, over a course one mile long in Newark Bay, June 21st, showed a speed of 43 13 miles per hour, the best performance being 1 minute 22 1/5 seconds for the run north, which figures out 43.78 miles per hour. It is safe to say that this speed is as fast as any 20-footer has ever traveled. This boat is owned by Mr. Harry Payne Whitney. Next year may show us 50 miles per hour in a 40-foot boat. The use of the Government tanks at Washington, D. C., for testing out large-size models has been of great assistance in developing the lines of these vessels. This year will see our British cousins here again—their challenge has been received—to try to win back the Harmsworth trophy; and there may be other foreign boats in the contest. Will some scientific American prove equal to the task of defending it?

A hydroplane at low speed, not planing.

"Baby Reliance," a new type for 1912. Built in May.

The "Saurer Lurssen" hydroplane at full speed.



Copyright 1912 by Edwin Levick.

20-foot "Dixie Jr.," with a speed of 43.78 miles per hour.

[1] Nearly fifty years ago Mr. Ramus, a clergyman, conceived the idea of driving vessels over the water instead of through it, and tried his scheme in the British Admiralty experimental tank at Torquay; but it failed because of the poor ratio of power to weight.

The Value of Radium

THERE are no very exact statistics of radium available, but according to the United States Geological Survey the whole quantity in the world is probably not over two or three ounces, and its value, like that of the big diamonds of the world, is purely nominal. It is worth whatever the possessors can get for it. The head of the English corporation producing radium claims that it is worth approximately \$100,000,000 a pound. A year ago this same person had estimated the value of radium at one third more. However, a little variation of \$50,000,000 is not thought to matter where there is no appreciable fraction of a pound of the precious stuff in sight. The fact that has more than anything else to do with fixing the price is the existence of several radium banks in the world where tubes containing a microscopic speck of radium are rented out to doctors at something like \$50 a day. While it is known to be of some value in treating lupus, which is a form of tuberculosis attacking the tissues, usually of the face, there is little else known about its medical value. It has been claimed on several occasions that radium was valuable in the treatment of cancer, but experiments have not proved this to be an absolute fact.

A short time ago it was reported that the Austrian government had purchased the only two mines under private ownership producing the ores from which radium is made, and thereby gained a monopoly in its manufacture. This report, however, turned out inaccurate. It is true that the Austrian mines and the Austrian government heretofore have supplied the bulk of the radium salts existing in the world, but at the present time radium is being manufactured in three other countries, the United States included. Sweden is producing radium from kolm, the English are getting it from mines in Wales, while we get it from western Colorado, where there is a large deposit of radium-producing ore. These deposits produce also uranium and vanadium, the latter being used for making some of the high-grade steel alloys. While the mining pays in vanadium alone, the ore produces a certain per cent of radium. Ten tons of it procure only between twenty and thirty milligrammes of radium.

The Flight of Projectiles

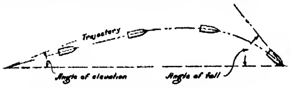
The Actual Positions of a Shell from Gun to Target

By Rear-Admiral N. C. Twining, U. S. N., Chief of the Bureau of Ordnance

"THE axis of a projectile in flight is at all times sensibly tangent to the trajectory." Sketch No. 1 shows the positions which a projectile takes in the different parts of its trajectory.

A large number of persons believe, however, that the axis of a projectile in flight remains parallel to its direction when fired. These persons believe the positions of the projectile to be as shown in sketch No. 2.

It will be sufficient for the present to state that these persons (of whom there are a surprisingly large number) are wholly in error, and that a projectile in flight cannot possibly take the positions shown in sketch No. 2.

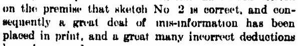


Sketch No. 1.—Shows actual position of projectile during flight from gun to target.

The discussion as to whether sketch No. 1 or sketch No. 2 is correct has continued for many years, and has long been considered a moot question. It has frequently been stated that authorities differ on this question. This is not quite true, for it will be found on investigation that all "authorities" are of the same opinion. There is absolutely no doubt that the believers in sketch No. 1 are correct, and that those who believe in sketch No. 2 are in error.

It is important to establish the correctness of sketch No. 1, as many articles and criticisms have been written on the premise that sketch No. 2 is correct, and consequently a great deal of mis-information has been placed in print, and a great many incorrect deductions have been made.

In investigating the flight of projectiles, it is not apparent why so many have been led to believe that sketch No. 2 is correct. There is neither theory nor fact to support such belief. It is stated that owing to the "gyroscopic principle," a projectile will remain parallel to its original direction. The assumption is wholly incorrect, for although a rotating projectile is a gyroscope, there is no gyroscopic principle which allows a projectile to remain parallel to itself while it is being acted on by the force of the air resistance.

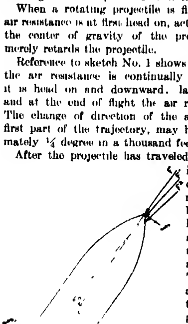


Sketch No. 2. False idea of positions of projectile during flight.

When a rotating projectile is fired from a gun, the air resistance is at first head on, acting in a line through the center of gravity of the projectile. This force merely retards the projectile.

Reference to sketch No. 1 shows that the direction of the air resistance is continually changing. At first it is head on and downward, later it is horizontal; and at the end of flight the air resistance is upward. The change of direction of the air resistance in the first part of the trajectory, may be taken as approximately ¼ degree in a thousand feet.

After the projectile has traveled a short distance in its trajectory the direction of the air resistance changes, bending toward the horizontal, the resultant force striking the projectile as at F', sketch No. 3. The force F' does not act through the center of gravity of the projectile, but forward of it, creating a small overturning moment, or "gyroscopic moment," represented by $F'a$. If there were no rotation this moment would tend to overturn the projectile; but as the projectile is rotating, the overturning moment causes the projectile to begin to precess about a line passing through the center of gravity of the projectile and parallel to the direction of the force F'. This line is sensibly the direction of the trajectory.



Sketch No. 3.—Air resistance against projectile during flight.

The force F' strikes under the point of the projectile, and if the projectile has right-hand rotation, it will start precessing to the right. The projectile behaves quite like a top that has not gone to sleep. The top is rotating, while its axis is precessing or wabbling. There is this difference, however, that the top makes a number of complete precessions, while the projectile makes only partial ones, as will be explained. It must be understood that owing to the high speed of rotation of the projectile (4,000 to 20,000 revolutions per minute, or even greater), and the relatively small overturning moment of the air resistance, the time necessary to make a complete precession would probably be one or more seconds, depending on the projectile, its speed of rotation, and the overturning moment. If the overturning moment decreases, the speed of the precessions decreases.

Before the projectile has finished more than a part of a complete precession, it has traveled several hundred feet, and the direction of the air resistance has again changed to F'', striking the projectile slightly farther under the point. The first precession is arrested before more than a part of a precession has been completed, and another precession starts about the new direction of the air resistance, the point of the projectile again bearing off to the right (as viewed from the rear). As the direction of the air resistance changes again and again, new precessions are started before previous ones are more than partly completed. The point of the projectile, therefore, describes a series of cusps, the horizontal traces of which are practically cycloids, appearing somewhat as shown in sketch No. 4. The point of the projectile for right-handed twist remains for the most part to the right of the vertical plane of the trajectory.

The overturning moment (which depends on the air resistance and the lever arm) is balanced in a sense by the speed of the precession. With a given speed of rotation of a projectile, if the overturning moment decreases, the precessions become of greater period. As the changes in direction of the air resistance are relatively small, and as new precessions are started with every considerable change of direction, it follows that the amplitude of the precessions is small, and the axis of the projectile never diverges more than a few degrees from the trajectory.

As the projectile reaches the latter part of its trajectory its speed of rotation diminishes but slightly, while the overturning moment falls off very greatly, due to the large reduction in the air resistance. The precessions in this part of the flight are, therefore, slower, and of greater amplitude. This is indicated in sketch No. 4.

In addition to the overturning moment caused by the resistance of the air, there are also frictional forces which oppose the rotation of the projectile. These forces act at right angles to the head-on resistance, and the effect over the whole projectile may be represented by a force at each end of the projectile acting in opposite directions, as shown in sketch No. 3. These forces are the equivalent of a force f-f', acting through the center of gravity, and a couple tending to depress the axis of the projectile toward the trajectory.

As soon as the axis of the projectile becomes tangent to the trajectory, the friction forces disappear, as the friction then becomes symmetrical about the axis.

The force f-f' moves the projectile bodily sidewise, and is one of the elements causing drift. The friction couple assists in keeping the axis of the projectile tangent to the trajectory.

This friction force is quite like the friction acting on the peg of a top. The axis of the top is finally brought into line with the direction of the force of gravity by the friction on the peg acting at right angles to the force of gravity.

There is absolutely no proof, theoretical or otherwise, that a projectile in flight will remain parallel to its direction when fired, while the theory of gyroscopes shows plainly that the direction of the axis of the projectile must depress continually to meet the changing direction of the air resistance.

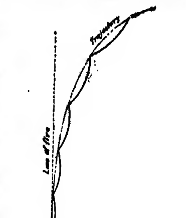
In addition to the theory, the following tangible proofs show conclusively that the axis of the projectile is at all times sensibly tangent to the trajectory:

(a) Cardboard impact.
(b) Photographs.
(c) Reports of observers.
(d) Reproduction of motions with air currents and model projectile.
(e) Penetration of armor.
(f) Retardation of velocity in flight.
(g) Explanation of drift.
(h) High-angle fire.

Cardboard Impact.

It is evident that if a projectile in flight should hit a target which offered practically no resistance, the projectile would pass through the target without being deflected, and would make in the target a hole indicating the position of the projectile in flight.

In October, 1909, at the Naval Proving Ground, Indian Head, Md., firing took place with an 8-inch gun at a cardboard screen, the range being 7,600 yards. The angle of elevation of the gun was about 9 degrees, 30 minutes, and the angle of fall 13 degrees, 45 minutes. Reference to sketch No. 5 will show that if the projectile had remained parallel to its original direction, an oblong hole would have been made in the cardboard about 15.35 seconds in length. The hole actually made in the cardboard was practically circular, having a diameter of about 8.23 seconds. This evidence is conclusive that the axis of the projectile must have been practically tangent to its trajectory.



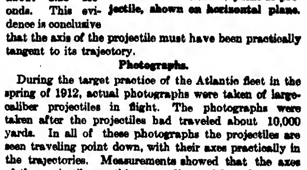
Sketch No. 4.—Path of point of projectile, shown on horizontal plane.

Photographs.

During the target practice of the Atlantic fleet in the spring of 1912, actual photographs were taken of large-caliber projectiles in flight. The photographs were taken after the projectiles had traveled about 10,000 yards. In all of these photographs the projectiles are seen traveling point down, with their axes practically in the trajectories. Measurements showed that the axes of the projectiles at this range diverged less than 2 degrees from the tangents to their trajectories.

Reports of Observers.

Many observers at target practice, and at other firings, have reported seeing projectiles in flight striking with their points following the trajectories. In no instance has any report been received of a projectile falling point up, as in sketch No. 2. Observers of mortar firing have reported that the axis of the projectile, both in the ascending branch and in the descending branch, follows the trajectory.



Sketch No. 5.—Showing by impact of projectile on card, actual position during flight.

(To be continued.)

Loetschberg Tunnel Approaching Completion.—The Loetschberg tunnel, which has been driven through the mountain on the right bank of the Rhone, and which will form an outlet from the Simplon tunnel to the northward, is practically completed. The tunnel carries a double-track railroad and is lined throughout its full length, which is slightly over 9 miles, or 47,??? feet.

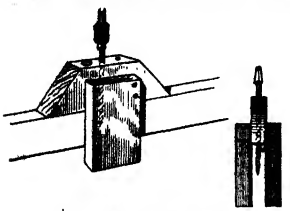
Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

Gage for Boring Dowel-pin Holes

By William Grötzinger

IT is often a difficult matter to bore straight dowel-pin holes in two pieces of wood, which are to fit together squarely and tightly. The following description of a gage for the purpose should be readily understood: It is made from a piece of oak board, with two side pieces screwed so as to form a socket in which the work fits and is held squarely. A number of different size holes are bored into the oak piece, so that bits of different sizes can be used, for large or small dowel-pins. Mark the work with a pencil where the holes are to be bored, put the gage over the work, and put the bit in the holes of the desired size. Be sure to get the bit on the pencil mark, then bore the hole. If the gage happens to fit a little loosely, it can easily be made tight by wedging it with small wooden wedges.

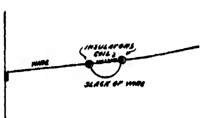


Gage for boring dowel-pin holes.

Reducing Noise of Telephone Wires

By R. D. Mock

A WIRE, especially one with a long span, is sometimes a noisy proposition when it is attached to the clapboards of a house. Every time the wind blows a little harder than usual there is such a moaning and groaning that sleep is well-nigh impossible. The wire seems to make a noise on the principle of the old-fashioned squawker boys used to make out of a tin can with a stout thread fastened to the bottom of it. Pulling the thread would produce a fiendish noise. And every time the wind would make the wire give a pull on the house, it would sound like that old tin can. In my case, the telephone wires were the offenders.



Noise reducer for telephone wires.

The next time a lineman was in the neighborhood I got him to give me about a foot of slack on each line. Two very stiff coil springs and two pairs of porcelain insulators then did the work. Each wire was wrapped around two of the insulators in the regular way and then a spring was inserted between the two, as may be seen in the diagram. The other wire was handled in the same manner. The spring was stiff enough to draw the wire up to nearly its usual tautness, and yet it was elastic enough to take up all the jerks and unusual pulls that formerly made so much noise. Everybody slept much better on blustery nights after this. Of course the main thing is to get a stiff enough spring so that the wind will not pull it out.

A Cheap Pipe Wrench

By H. C. Urbaner

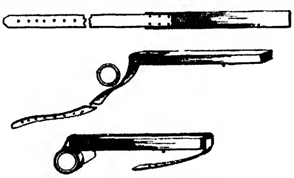
QUITE frequently it becomes necessary to have a pipe wrench, especially for brass tubing, that will not mar the work and yet at the same time will permit of using sufficient force to produce the required results without crushing the tubing.

Fig. 1 shows one of the cheapest, simplest, and yet most efficient of pipe wrenches. It consists of two parts: A piece of hard wood about $1\frac{1}{2} \times 1\frac{1}{2} \times 18$ and a piece of strong 3-inch leather belting about 3 feet long. The strap should be riveted to the wood with the heads well sunk below the surface of the wood on the side opposite the strap side of the lever. The loose end of the strap should have holes punched at intervals of one inch or so to make it adjustable to the work with the stud the opposite side of the bar. The strap should be turned down over the end of the lever, then up and around the work and back along the top of the lever and around the opposite end, where it is fastened to the stud on the under side. The object of throwing the strap around the end of the lever rather than to fasten it at the end is to insure a maximum amount of pull on the strap with a minimum strain where it is fastened to the stud. Use this device like any other pipe wrench. To release the wrench for another pull, simply pull it away from the pipe far enough to allow it to loosen its grip and begin for the new pull by simply repeating the first operation. The end of the strap must not be taken from the stud after it is adjusted until the operation of turning the pipe is completed.

With the use of this wrench, an even strain is placed upon the tubing on its entire surface without any possible danger of marring or crushing it.

With a few trials the work can be done as quickly as with an open pipe wrench.

The writer has employed this idea in many different ways, and finds it most helpful. When a fountain pen



Pipe wrench for polished brass.

cap "sticks" take a little stick and a piece of dampened cord and in a moment it is loose.

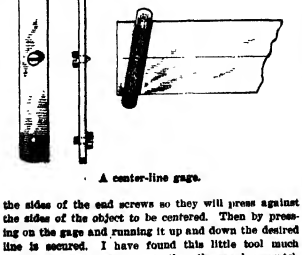
A few years ago the writer had occasion to unscrew the first joint of a 2-inch pipe in a tubular well in order to find the end of a broken wooden rod inside. As no large pipe wrench was at hand one was made as here described from a 4-foot piece of oak scantling and a strip of $1/16 \times 2$-inch hoop iron purloined from a vinegar barrel. After setting the wrench two strong men pulled on the 4-foot lever with all their strength to start the pipe.

Center-line Gage

By Henry Klotz

THE accompanying sketch shows a handy little tool which for want of a better name I call a center-line gage. It is very useful on many jobs, and is easily made as follows: A piece of iron or steel about ⅛ inch thick and 1 inch wide is drilled and tapped to receive three screws as shown in drawing. The point of the center screw can be hardened so as to wear better, but this is not essential, as it can easily be sharpened when dull and replaced in position.

When it is desired to mark a center line on a piece of wood or metal, place the gage over it and bring



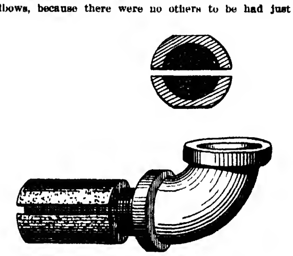
A center-line gage.

the sides of the end screws so they will press against the sides of the object to be centered. Then by pressing on the gage and running it up and down the desired line is secured. I have found this little tool much more convenient and accurate than the regular scratch gage for centering.

Unscrewing Nipples from Pipe Fittings

By G. H. Ander

WHILE doing some pipe fitting the other day, the writer needed some close nipples and was obliged to take apart and use old ones, stuck in tees and elbows, because there were no others to be had just



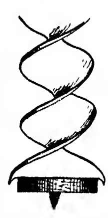
Device for unscrewing nipples.

then. It was impossible to get the old nipples loose with a wrench or in a vise without spoiling the thread, so a pipe-cap of the same size as the nipple was procured. This cap was cut in two with a hacksaw. The two halves were placed on the nipple, after first having filed them flat on the sides, in order to prevent them from turning around in the vise, while unscrewing the nipple. This method proved to be very successful. The nipples came out without any injury whatsoever.

Enlarging a Bore With an Auger

By F. H. Jackson

THE following kink should prove useful for plumbers or gas-fitters. When boring a hole through a joist for a pipe, the auger ran into a knot, throwing it a little out of line, so that the pipe when run through the hole would not screw into the fitting. The trouble was overcome by fitting a small circular piece of wood of same diameter as hole, on the spur of a larger auger which made a guide, and the hole was easily enlarged to a suitable size.



Enlarging a bore.

Shop Notes

Cuttlefish Paper.—Some years ago my attention was called by a professional friend, a dentist, to a paper which is sold by the dental supply houses under the name of "cuttlefish paper," and which is used by dentists to polish gold fillings, it being for this purpose cut into narrow strips, passed between the teeth, and pulled back and forth over the filling. The abrasive material on this paper (which comes in sheets about the size of ordinary sandpaper) is of such a degree of fineness, that it is difficult to tell which side of the paper is coated. The paper, which is apparently practically unknown except to dentists, has other very valuable applications. It is an ideal material for the rapid honing of razors and of surgical and other instruments requiring a fine edge. Its cutting qualities are so rapid that a pocket-knife blade of ordinary degree of sharpness can, by giving it fifteen or twenty diagonal strokes on a piece of the cuttlefish paper, laid flat, and followed by a slight stropping on a leather strop or shoe top, be brought, in the space of a couple of minutes, to such a degree of sharpness that it will remove the hair from the back of the hand or arm as though it were a razor in fine condition. In honing razors, especially those that have a rounded edge and need honing badly, it will produce results in one or two minutes that would require a half hour or more on a stone hone. For this purpose the paper is drawn over a level wooden block, and turned over the ends and tacked or clamped in place; the razor is then laid perfectly flat, and given diagonal strokes in both directions, drawing away from *the edge*. Ten to twenty strokes in each direction will usually be sufficient. A moderate amount of stropping will remove the slight feather edge sometimes produced, and leave the razor in fine condition for shaving. So far as I know, the paper is obtainable only through dental supply houses.—Claude L. Woolley.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Automatic Control for Aeroplanes

AN aeroplane maintains a constant level in the air by maintaining a constant speed through the air If the air is in motion, the matter is complicated by the fact that the winds never move with constant velocity The steadiest of winds is interrupted now and then by a lull, and sometimes a wind is made up of a succession of puffs. An aeroplane when moving in a variable wind, particularly when moving in the direction of the wind, must bob up or down, depending on its velocity with respect to that of the wind. Under these conditions it finds the same difficulty of keeping its equilibrium that one experiences when trying to walk on a shaking platform, such as found in our amusement parks. Conditions would be the same were the machine flying in quiet air, while its engine was retarding and accelerating irregularly. The only cure for its staggering course in fickle winds is to compensate for the retarding and accelerating of the wind by accelerating and retarding the engine to a corresponding degree

As a rule, aviators depend on hearing and touch to determine their speed through the air. But the best of pilots often find it difficult and impossible to account for variations of speed experienced during a flight. The balance of an aeroplane is so delicate that even in still air, it often swerves from unsuspected causes. Capt Etévé of the French army states that more than four fifths of all aeroplane accidents are due to loss or excess of speed, and he believes that it is essential to good flying that the pilot of an aeroplane be provided with an instrument which will show the speed of his machine over the air. He devised a simple instrument of this sort, which is shown in Fig 2.

It consists of an aluminum plate A with a dial sector on which is a prominent red reference mark shown at B. The indicator needle C is secured in a block pivoted at D Rising vertically from this block is a rod, on the upper end of which is a hollow sphere E; a bob F below the block serves as a counterbalance, while a spring G may be adjusted to hold the sphere E in vertical position, and the pointer C on the mark B when the aeroplane is traveling at a certain pre-determined speed. As the instrument moves through the air in the direction of the arrow, the wind pressure on the sphere E causes the latter to swing on its axis D, and depress the pointer C, when the speed exceeds that for which the instrument has been adjusted. On the other hand, if the speed decreases, the spring G causes the pointer to rise above the mark B. This instrument is very sensitive and provides the pilot of the aeroplane with an accurate gage of his speed

The extreme sensitiveness of the apparatus has given the hint to Capt. W. I. Chambers of the United States Navy to employ a speed indicator of this general character for the automatic control of the elevating rudder of the aeroplane Capt. Chambers' instrument is shown in Fig. 1, which is partly broken away to show interior details. Like Capt. Etévé's speed indicator, it is provided with a dial sector B, and a pointer C, connected to a sphere E, which projects in the path of the wind At each side of the safety mark B are arms J bearing contact buttons with which the pointer C is adapted to come into contact when the speed of the aeroplane exceeds or falls below the safety limit The electric circuit is thus closed to elevate or depress the horizontal rudder of the aeroplane The arms may quickly be adjusted by the pilot while in flight to suit any condition

Mounted on the rod which bears the sphere E is the crosshead, from which are suspended upon a pair of very flexible spring bands I, weights K, that are adjustable on stems. The spring G pulls the rod on which the sphere is mounted and its tension is regulated by means of the screw L. A variety of adjustments are thus provided, first, the sphere E; second, the spring G; third, the crosshead H; fourth, the springs I; and fifth, the weights K Thus ample flexibility is assured for the power and the sensitiveness of the pressure sphere and for the power and the sensitiveness of the accelerating action of the weights K, which operate above the axis D.

In a separate compartment of the instrument there is an electric lamp M, in front of which is a slotted cylinder N, which may be turned so as to allow the light to pass through the slot and illuminate the dial sector. This illumination may be made as bright or as dim as desired by rotating the cylinder. Above the instrument a 2-inch barometer O may be mounted, receiving its light through a slit as indicated at P, the light being reflected to the barometer dial from a small semi-circular reflector above its face Thus we have, combined with a flexible automatic stabilizing device of light weight, an effective speed indicator, which is always adjustable to suit the conditions of flight and is always available for use in event of motor derangement

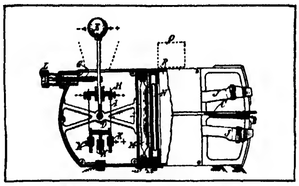


Fig. 1.—Combined speed indicator and automatic stabilizer.

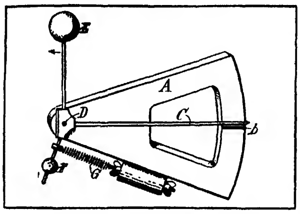
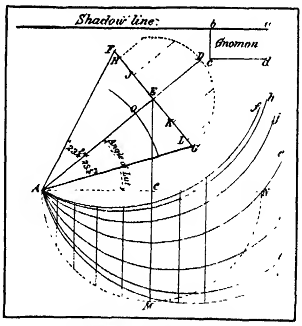
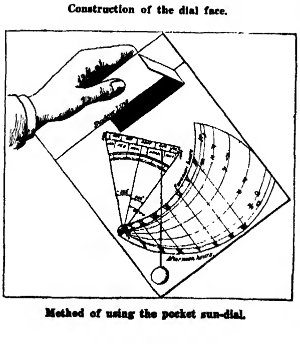


Fig. 2.—Speed indicator for aeroplanes.



Construction of the dial face.



Method of using the pocket sun-dial.

A Pocket Sun-dial

By Dr. Leonard Keene Hirshberg

A NOVEL form of sun-dial has recently been devised by Mr. F. N. Lovegrove of London, England. Not only does this dial give the hour, but by it may be found the time of sunrise and sunset in any part of the country, also the sun's declination and the date of its entry into any constellation of the Zodiac. The sun-dial consists of a sheet of cardboard in the upper end of which a piece is cut out, so that it may be bent up to form a gnomon. When the shadow cast by the gnomon falls on a shadow line drawn on the cardboard, the time is determined by the position of a bead on a plummet line. The plummet line is adjustable in a slot to allow for variations in the declination of the sun at different dates throughout the year. The dial may be laid out as follows:

Draw first a shadow line near the upper edge of the cardboard, and near the middle of the cardboard draw the line AB parallel to the shadow line. Draw a line at right angles to AB, intersecting it at C. Extend this line to intersect the line AD at the point E, the line AD forming an angle with the line AB equal to the latitude in which the sun-dial is to be used. For instance, in New York, which is at latitude 40 degrees, the line AD would form an angle of 40 degrees with the line AB. Through the point E draw the line FG at right angles to AB, and the lines AF and AG forming angles of 23½ degrees with the line AD. With E as the center, describe the semi-circle FDG. Divide the arc into six equal parts and drop perpendiculars to the line FG. From the point F as the center with a radius equal to AF, draw the arc Af, and from the point H as the center with a radius equal to HA, draw the arc Ah and so on. Upon these arcs are drawn the hour lines, which are obtained in the following way: From C as a center with a radius equal to AC, draw the semi-circle AMN; divide this curve along the circumference into twelve equal parts, and from the points of division thus found, drop perpendiculars to the line AB. The hour lines may then be numbered as shown in the drawing. Mark the line Af with the zodiacal sign of Capricornus, and the line Ah with the signs of Aquarius and Sagittarius, the line Aj with the signs of Pisces and Scorpio, and so on with the rest of the arcs. The zodiacal signs may be found in any almanac.

The date line may now be laid out. An arc is drawn at O. This is calibrated in degrees of a circle. Then referring to an almanac for the declination of the sun at different times of the year, the line FG may be graduated to show the various positions of the sun for different months. For instance, the sun's declination on the first of August is 18 degrees north, and on the last of August is 8 degrees and 41 minutes north. By extending lines from A through the corresponding degrees in the arc O, the points where they intersect the line FG will mark the month of August on the date line. This space may then be sub-divided into thirty-one parts if desired to indicate the different days of the month. After the date line has been laid out, a slit is cut in the cardboard along the line FG. The gnomon is also laid out along the shadow line. The lines ab, bc, and cd are cut through, leaving the line ad uncut. On this line as a hinge, the tab of paper is bent up. A thread is now passed through the slit FG, and upon it a bead is fitted. A knot on the thread keeps it from slipping through the slit. The lower end of the thread is weighted with a small piece of metal. The sun-dial may then be used as follows:

If the observation is to be made on July 15th, the thread is moved in the slit to the corresponding position on the date line, and then is stretched across the 12 o'clock point and the bead is moved up to cover this point. Then the dial is held in the sun so that the shadow cast by the gnomon falls along the shadow line. The bead will swing down along the arc Al, and will come to rest over the hour of the day at which the observation is taken. When the plummet line hangs parallel to the line CM the bead will denote the hours of sunset and sunrise for that particular day. By stretching the plummet line across the point A, the declination of the sun for that particular date may be determined on the arc O. As in all sun-dials, allowance must be made for Greenwich time. The difference of longitude must be allowed for at the rate of four minutes for every degree, subtracting from sun-dial time to the east and adding to it the west. For instance, when it is five o'clock on the seventy-fifth meridian, from which time in the eastern section of

the United States is taken, the sun-dial will give the hour as four minutes past five in New York, which is on the seventy-fourth meridian.

The Trade-mark as a Business Asset

By W. E. Woodward

[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the fifth of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

Analysis of the Requirements for Registration.—V.

(*Continued from page 108, August 3d, 1912.*)

Many applicants for trade-mark registration seem to think that the mere misspelling of a descriptive word, or some fanciful device in lettering, will remove the word from the descriptive class. This is a belief that has no basis in fact; for no matter how a word is spelled or lettered, it is descriptive if it conveys information of a descriptive character.

For instance, the word "Bestok" was rejected as a misspelling of "Best Stock;" "Unxld" as a misspelling of "Unexcelled;" "Kid Nee Kure" as a misspelling of "Kidney Cure;" and "Pittsburgh Pump," printed with hyphens between the letters —P-I-T-T-S-B-U-R-G-H P-U-M-P—was refused registration as being both descriptive and geographical.

The courts have held that the word "Elastic," used to designate drawers having an elastic seam, is descriptive, but the same word is used in a fanciful sense and is valid as a trade-mark when applied to sectional bookcases.

A manufacturer of hooks and eyes applied for registration of the phrase "Rust? Never!" as a trade-mark. Registration was refused, as the mark was held to be descriptive, indicating that the hooks and eyes would never rust.

Arbitrary numbers are obviously registrable as trade-marks, but the applicant must be prepared to establish his contention that the numbers are really arbitrary and meaningless. In certain trades, numbers are used to designate grades of a product common to the trade, and, in that case, the grade numbers are descriptive by common usage. A plow manufacturer applied for registration of the symbols "A No. 1," "No. 1" and "AX No. 1" as trade-marks for plows. It was shown, upon examination, that these symbols are used by many plow makers to designate grades, and they were, therefore, ordinary descriptive trade terms. Registration was refused.

The prohibition against trade-marks descriptive of the character or quality of the product applies with equal force to trade-marks descriptive of the container or package. A flour manufacturer put up his product in barrels of a distinctive character—white and dark staves alternating. He applied for registration of a mark consisting of a pictorial representation of the striped barrel. This mark was considered descriptive, and registration was refused.

A Philadelphia candy manufacturer applied for registration of the word "Fussy," as used in the phrase "A fussy package for fastidious folk." The Patent Office held that the word "Fussy," as used in the phrase, was merely a descriptive term —an adjective qualifying "package"—and registration was accordingly refused.

The word "Spearmint," being a descriptive word, was refused registration as a trade-mark for Wrigley's Spearmint chewing gum, but the representation of a spear was considered registrable.

Various applicants have sought registration for trade-marks which, while they are meaningless to English-speaking people, are really descriptive terms taken from foreign languages. Such words are not registrable, for the Patent Office makes no distinction between languages. The phrase "Lait de Violettes," meaning the French "Milk of Violets," was rejected as a mark for perfumery. "Elegancia," the Spanish equivalent of the English word "Elegant," was rejected as a mark for perfumery. A descriptive word in a language as little known as Esperanto is, nevertheless, unregistrable. "Saniga" means "Sanitary" in Esperanto, and it has been accordingly refused registration on the ground of being a descriptive term.

In considering the question of descriptive marks, the difference between description and suggestion should not be overlooked. Suggestiveness is a highly desirable quality in a trade-mark, and many excellent and legally valid marks are suggestive. The name "Hydegrade," a registered trade-mark, applied to a well-known fabric, is suggestive of high quality, but it is not descriptive. It is a coined word, composed of the elements "Hyde" (name of owner) and "Grade." Another example of an excellent suggestive mark is "Rubdry" applied to towels.

Pictorial marks are often highly suggestive without being descriptive. The Baker Chocolate girl, depicted in the act of serving a cup of cocoa, suggests daintiness, taste, beverage, quickness in serving, and refreshment.

The word "Ideal," used in connection with a fountain pen, is considered fanciful, and not descriptive. It would seem that a very fine distinction is made here, as this word is an ordinary descriptive word, commonly used to express a state of perfection, as in the expression "An ideal day." It may be said, on the other hand, that nothing ever reaches an ideal condition, and, in that sense, the mark may be considered fanciful.

Geographical names, like descriptive terms, are the common property of all who use the language. No one manufacturer can appropriate such a term for his own exclusive use as a trade-mark unless he uses it in an arbitrary or fanciful sense. The only exceptions to this principle are to be found in the case of manufacturers who have adopted geographical terms as their trade-marks and have used them so long, without opposition or protest, that they have acquired a common law right to their exclusive use.

Among the geographical marks rejected by the Patent Office are the following:

"Yale," applied to hosiery; "Cloverdale," for canned fruits and vegetables; "Red River Special," as a mark for agricultural implements; and "Aurora" on shoes—the name "Aurora" being applied to localities in at least twenty States of the Union.

It would seem in the light of common-sense, that in the last-named case (that of "Aurora") the ruling of the Patent Office is on a very narrow basis indeed. The word "Aurora" has no geographical significance to the average person. It calls up a mental image of the dawn. If this case, and some others like it, are considered valid precedents, every applicant for trade-mark registration must be prepared to submit his application to the stern criticism of the Post Office Directory, with its catalogue of fifty thousand or more names. (It is interesting to observe that, in a later case, the Patent Office allowed the registration of "Aurora" as a trade-mark for oils, lard, syrup and honey.—Aspegren & Co., ex parte, 100 Official Gazette, 684.)

"Tabasco" was refused registration as a mark for a sauce on the ground that it is a geographical term, Tabasco being the name of a State in Mexico. "French" was rejected as a trade-mark for paint. On the other hand, "Celtic" has been registered as a trade-mark for tea. The word "Celtic" has reference to a race, of which the Irish are only one branch. It is not applied to any particular country or section of the globe.

The map of the United States has been refused registration as a trade-mark for sugar. "American Lady" was refused registration on the ground that the word "American" is geographical. When a geographical term, applied to merchandise, is used in a fanciful or arbitrary sense—that is, when it conveys no deception in regard to the origin of the merchandise—it may be registered as a valid trade-mark.

"Dublin" is a valid trade-mark for soap, although the soap is made in America. In the case concerning this mark it was shown that it is the practice of soap manufacturers to call their products "Limerick," "Scotch," "Irish," etc., and that the buying public is aware of the fanciful use of these names and is not deceived thereby.

"Vienna," applied to bread, is considered valid. No one expects bread made in Vienna to be sold in America, consequently no one is deceived by this fanciful use of the word.

"Gibraltar" is registered as a trade-mark for belting. It is true that Gibraltar is a geographical name, but its suggestiveness in regard to belting conveys the mental picture of strength, rather than the idea of origin.

The student of trade-mark conditions, having learned how rigorously the Patent Office interprets the section of the law applying to the registration of geographical terms, will perhaps be puzzled by the number of trade-marks of this class which seem to be valid and well-established.

The explanation of that is that many geographical names, which could not have been protected *ab origine* as trade-marks, have acquired a secondary meaning by long and exclusive use by a particular manufacturer. Such marks fall within the protection of the common law.

Some of these common-law marks are registered under the ten years' clause. Among well-known geographical trade-marks may be mentioned "Bristol" applied to fishing-rods; "Kalamazoo" applied to stoves; "Manhattan," the name of a brand of shirts; and "Elgin," "Waltham" and "Illinois," the names of watches.

(*To be continued.*)

Notes for Inventors

A Coat and Suspended Trousers.—Patent No. 1,031,719 to G. A. Kurz of Zanesville and H. C. Shonting of Columbus, O., discloses a coat with trouser legs supported from within the coat, and straps which are detachably secured to the upper ends of the trousers legs.

Preserving Oil Paintings by Nitrogen Gas.—In patent No. 1,031,727 Karl Mussbeck of Munich, Germany, has a means for preserving oil paintings, provides a casing for the painting having a glass plate to inclose the painting which casing is air-tight and supplies a charge of nitrogen gas within the casing.

An Abrasive Bowl that Pares Vegetables.—This vegetable peeler patented to Henry Robinson of South Orange, N. J., No. 1,031,735, includes a bowl-like receptacle which is rotated upon a vertical axis and has its inner side walls provided with an abrading surface which when revolved or moved in contact with the vegetable operates to remove the skin therefrom.

Storing and Launching Lifeboats.—A number of lifeboats are nested one in the other and carried from the ends of swinging davits by independent hoisting ropes and blocks so the lifeboat can be launched successively from the same davits from which they are suspended. The patent, No. 1,033,480, was issued to Henry A. Seymour of Washington, D. C.

A Novel Pneumatic Tire.—James P. Clare of Stratham, New Hampshire, has secured a patent, No. 1,033,229, for an inflatable tire which comprehends two separate tubes combined to form the tire. The two separate tubes are united to form a tire body and are so arranged and united that each separate tube will form a separate compartment, and portions of the combined tubes will form a third compartment.

Making the Kettle Shut Off the Heat.—Knud Valdemar Rotzov of Malmo, Sweden, has patented, No. 1,031,874, a device for controlling the heat by the steam from the liquid being boiled. In doing this he provides a cooking apparatus with a heating producing medium in the form of gas and a valve for regulating the supply of gas. The heat causes liquid to boil and the steam from the liquid being boiled by its condensation, operates upon the regulator for controlling the supply of gas.

A Novel Core for Elastic Tires.—William Barbour of Glasgow, Scotland, makes an elastic or resilient body as a filler for cushion tires and the like which comprises an inner member or body formed from the depilated hides of animals in a moist condition and an outer member inclosing said inner member and of water-proof material so it will conserve the moisture of the inner member, the depilated hides being wound under tension. Patent No. 1,031,671 has been issued to Mr Barbour for the invention.

A Bill to Authorize the War Department to Test Upon Ships a Device for Hoisting and Lowering Lifeboats at Sea.—Mr. Peters has introduced in the House of Representatives a bill authorizing the Secretary of War to construct and test upon one or more army transports or other ships in the War Department, the device for hoisting and lowering lifeboats at sea devised by A. S. Eells of Boston, Mass., and to meet the expenses out of any money in the treasury not otherwise appropriated.

A George Westinghouse Turbine.—In patent No. 1,031,757, George Westinghouse of Pittsburgh, shows a re-entrant turbine which has a bladed rotor element with a fluid discharging device which is movable toward and from the rotor and a stop on the turbine stator is arranged to limit the movement of the fluid discharge device toward the rotor. In the same issue Mr. Westinghouse patents, No. 1,031,759, a vehicle supporting device in which pneumatic cylinders are pivotally supported in connecting yokes and are interposed between the yokes and the axle of the vehicle forming stress transmitting devices.

Versatility of Women Inventors.—Women have not only patented cooking utensils and other household appliances, but many inventions along other lines have been made by them, as the records show that they have secured patents for cultivator attachments, baling presses, dump wagons, vehicle brakes, barrel taps, window frame and sash, calendar clocks and electric clocks, watch makers calipers, numerous educational appliances, heating apparatus, gas making apparatus, electro medical appliances, horseshoes, motors and wind mills, plumbing devices, railway appliances, theatrical apparatus and in numerous other mechanical fields.

Legal Notes

Recent Adjudicated Patents.—Out of nine adjudicated patents reported in the *Patent Office Gazette* of July 9th, 1912, only one was held void. In the other eight cases, two patents were held valid and infringed and in five cases no infringement was found.

A Door in an Interference Proceeding.—In an interference case of Summers v. Clark involving priority of invention of a door arrangement for dump cars, in which the doors at the bottom of the car roll open laterally of the car to discharge the load, the Court of Appeals of the District of Columbia in reversing the decision of the Commissioner of Patents, and awarding judgment to Summers, said it was constrained to believe with the Examiner of Interferences and the Examiner in Chief that Clark is not an independent, original inventor of the subject-matter in question.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Electrical Devices.

TELEPHONE ATTACHMENT —J E ROSS, care of General Delivery, Cleveland, Ohio. The object here is to provide an attachment having an ear tube with members connecting the ear tube with clamping members, which embrace the conical portion of a telephone receiver, to press the cushion member mounted on the ear tube against the head of the receiver, around the opening of the said head.

Of Interest to Farmers.

INCUBATOR. —C. J. DITTBRENNER, P. O. Box 176, Cornwall, N. Y This incubator can be readily assembled and disassembled, and is arranged to insure a uniform heating of the eggs in the hatching compartment, to provide a proper circulation of air, to moisten the air, and to furnish a suitable running space or nursery for the hatched chicks

COW STABLE- J. A MONTGOMERY, Walton, N Y, deceased, Harriet I Montgomery, W H Montgomery, and M. C Montgomery, administrators This invention provides a stable where the atmosphere infolding the head and breathed by the cow is maintained separated from the atmosphere infolding the body of the cows, provides a flexible neck confining partition to be placed to permit the animal assuming various positions standing or recumbent; provides sanitary and inspection means and suitable ventilation augmenting devices for the head confining section of the stable.

Of General Interest.

SAFE DOOR.—G COOK, care of Dr R S Elliott, Laona, Wis The inventor provides means especially adapted for safes having circular doors, for receiving explosives introduced between the door and the safe, and through the openings of the lock and bolt operating means, and conducting the explosives away from the door, there to be exploded, or otherwise disposed of

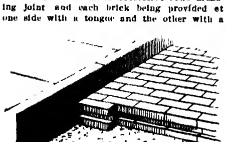
OILING ATTACHMENT FOR STREET SPRINKLERS —R E CARLTON and S Y CULLEY, Latonia Station, Covington, Ky This invention is an improvement in the application of oil to the surfaces of streets or roadways, which is desirable as is well known for the laying of dust as well as for the hardening of the road By the improvement oil is supplied at the same time the surface is sprinkled with water

BENCH —H A WHEELER and C W. WHEELER, Eddyville, Neb The principal object of the invention is to provide a convertible bench adapted to a variety of uses, particularly the needs of osteopathy and chiropractics, the construction and arrangement being such that the parts are movable relatively one to the other, whereby the outfit is capable of manifold application.

BAG HOLDER —L. A DYKEMAN, Maryland, Otsego Co, N Y This improved form of bag holder is especially adapted for use on counters An object of the invention is to provide a holder which is adapted to contain a number of pockets of varying sizes whereby bags of varying capacities may be held in convenient position for use.

RECEPTACLE —W J HAMILTON, care of Park Hotel, Franklin, Pa This invention relates to receptacles, and more particularly to barrels, and the purpose is to provide one with a plurality of side members having flanges which are engaged by sleeves for holding the side members together and against the heads which are disposed to cross in the side members

BRICK PAVEMENT —C. C PETTIT, Greenford, Ohio For the purpose of securing interlocking of adjacent rows of bricks to prevent displacement, shifting or sagging of a pavement at any one point over uneven or faulty foundation, use is made of interlocking rows of bricks, the bricks in successive rows breaking joint and each brick being provided at one side with a tongue and the other with a



INTERLOCKING BRICK FOR PAVEMENTS.

groove, both extending from one end of the brick to the other end thereof, and the tongues of the bricks in one row fitting into grooves of adjacent joint-breaking bricks in the next row, so that each brick in each row is sustained The engraving pictures a perspective view of the pavement

FILM CAMERA.—H. W HALES, Ridgewood, N. J. The main object here is to allow not only pictures of different sizes to be taken on the same roll of film at will, but to economize on the cost of operation by securing more exposures from the same roll or film, or if the usual number, then of a greater length than originally intended.

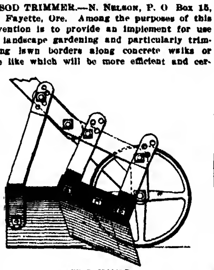
SAFETY RECEPTACLE —W. WINKELMANN, 494 12th St., Brooklyn N Y Bottles containing milk or other merchandise may be deposited in this receptacle, so as to prevent the latter from being tampered with by unscrupulous persons when the vender leaves

SAFETY RECEPTACLE.

them outside of the buildings. This simple inexpensive and perfectly secure device is normally maintained unlocked, but it may be automatically locked or placed in a receptive locking condition by the insertion therein of a full milk bottle or other merchandise. The accompanying illustration presents a vertical section of the receptacle showing it locked

Hardware and Tools.

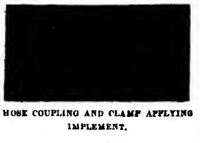
SOD TRIMMER.—N. NELSON, P. O Box 15, La Fayette, Ore. Among the purposes of this invention is to provide an implement for use in landscape gardening and particularly trimming lawn borders along concrete walks or the like which will be more efficient and cer-



SOD TRIMMER.

tain of operation than those usually employed, and that, too, with a minimum expenditure of power The adjustment of the mold board is intended to accommodate operators of different heights, and this adjustment may be made independently of the adjustments of the cutter, the board being adapted to swing on the pivot according to such adjustments. The engraving gives a clear exposition of the trimmer in operative position

HOSE COUPLING AND CLAMP APPLYING IMPLEMENT —WM TANKERSLEY, La Junta Colo This patent, No. 994,664, consists of certain novel features which meets with enthusiastic reception by water, air and steam users, as it is adapted to the various



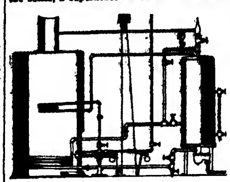
HOSE COUPLING AND CLAMP APPLYING IMPLEMENT.

sizes of fittings and makes of clamps, which are provided with two rings for various means. A spud for holding the fittings with an adjustable pin in gripping terminal, a slidable frame provided with a thumb screw for a clamping device, make it applicable to any place.

Heating and Lighting.

BURNER —J O BROOKBANK, Driftwood, Pa. This invention provides a burner for burning kerosene, coal oil, petroleum, gasoline or other liquid fuel, and is arranged to permit of conveniently and quickly starting the burner, to prevent overflow of the liquid fuel in the burner and to prevent the escape of obnoxious fumes or odors into the room where the burner is located.

OIL BURNING SYSTEM.—F. J. KARSEN, 420 Peavine St, Reno, Nevada For the purpose of this invention, use is made of a boiler connected with a source of water supply, and with the steam generator arranged in the shell of a heating apparatus separate from the boiler, a superheater in the said shell above



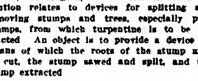
OIL BURNING SYSTEM.

the said steam generator and connected with the steam compartment of the boiler and with the burner proper located in the shell adjacent the steam generator, the burner proper being connected with a source of oil supply. The illustration herewith represents a side elevation of the system, parts being shown in section.

STOVEPIPE RETAINER.—W. H. PLEASANTS, Green River, Utah. This improvement provides a retainer to hold in operative position a stovepipe section to prevent the same from shifting in the stovepipe hole in the flue; provides a means for preventing the loosening of the holding devices therefor; and provides anchorage means to support other and connecting sections of the pipe.

Machines and Mechanical Devices.

GRINDING MACHINE.—G. W. HOADLEY, Garden Grove, Iowa The principal object of this invention is to provide a new and improved grinding machine made up of parts which are so arranged that the grinding wheel may be adjusted to different bevels and angles when it is desired to sharpen the sickle of a mowing machine, the construction and ar-



GRINDING MACHINE FOR MOWING MACHINES, ETC.

rangement of parts being such that the device may also be used for grinding chisels, axes, and the like. The device is also adapted to be held in such a position that it may be used as in the ordinary grinding wheel. The view pictures the device in use in grinding a mowing machine sickle.

MACHING FOR SPLITTING AND REMOVING STUMPS —A. S HUNTER, SR., 222 3d St., N. W., Washington, D C Mr. Hunter's invention relates to devices for splitting and removing stumps and trees, especially pine stumps, from which turpentine is to be extracted An object is to provide a device by means of which the roots of the stump may be cut, the stump sawed and split, and the stump extracted

BUTTON GRINDING MACHINE —W. HERZOG, 9 Prospect St, Garfield, N. J. This invention has for its particular object the forming of perfect buttons from "seconds" by means of a machine of simple construction containing relatively few parts, which is adapted to form buttons of different shapes and sizes.

PUMP.—G G. MCNEE, Box 442, Helper, Utah The inventor provides a pump more especially designed for irrigation and similar work, and provided with one, two, or more pairs of cylinders to permit of pumping a large amount of water in a comparatively short time, and without requiring much motive power for actuating the pump.

EXCAVATOR.—N. A. LYBECK, 1 Madison Ave., Room 6060, New York, N. Y. The employment of this invention is particularly designed for the construction of canals and for the maintenance of waterways, by permitting the same from being filled or impeded by sedimentary deposit or débris. An incidental purpose is to economize in the cost of the operation of constructing the canal and of maintaining the clearway of the stream.

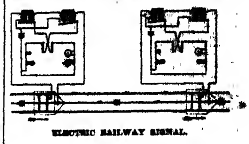
Prime Movers and Their Accessories.

GASOLENE FILTER.—F. CATCHPOLE, Pagosa Springs, Colo The device is intended more particularly for use in connection with the gasolene inlet of carbureters of gas engines. The inventors provide a water chamber below the gasolene chamber for receiving any water in the gasolene, and a filtering dome is arranged around the inner end of the gasolene inlet pipe. Below the filter dome is an adjustable guard which regulates the communicating space between the gasolene and water chambers, and prevents splashing of the water on the filter. It is especially for use with automobiles.

Railways and Their Accessories.

SIGNAL INDICATING DEVICE FOR RAILWAYS.—E. DEBRIE, 12 Rue des Capucines, Paris, France. This invention has for its object a signal indicating device for railways, and [illegible] the transmission of the [illegible] to the engine-driver, while [illegible] which causes the automatic [illegible] of the railway trains.

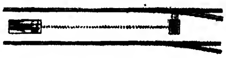
ELECTRIC RAILWAY [illegible] KISTLER, P. O. Box [illegible] [illegible] This invention refers to improvements in railway signals, and a particular feature of it is shown in a diagrammatic view of the arrangement of the signaling circuit when two trains are proceeding in the same direction. An object



ELECTRIC RAILWAY SIGNAL.

is to provide a device by means of which two engines which are approaching each other may be warned by means of signals to indicate such approach, when these engines are approaching head on, or when both are going in the same direction. Further, to provide means for indicating whether an engine is approaching from ahead or from the rear.

RAILWAY SWITCH.—A. COULOMBE, 91 Bullard St., New Bedford, Mass. In the present patent the invention relates to railway switches, and the object is the provision of a switch having a rock shaft extending longitudinally of the main tracks, with two arms



RAILWAY SWITCH.

secured to the rock shaft, one of the arms having means for operating the switch rail, and the other arm having means by which it is adapted to be operated by an adjustable member on a car. The accompanying illustration pictures the invention in a plan view.

Pertaining to Vehicles.

VEHICLE WHEEL.—V. SANFRY, Box 123, South Bend, Wash. This invention relates to an improvement in wheels, and particularly to resilient wheels, and has for an object the construction and arrangement of improved means which will present a wheel structure adapted to resiliently give when the wheel is in use.

WIND SHIELD FOR AUTOMOBILES.—W. A. PEARSON, Troy, Ohio. This inventor provides a shield having hinge members, which are held yieldingly relatively to each other by springs, so that the members of the wind shield may be disposed in a plurality of positions relatively to each other, and be supported relatively to the hinge members.

AUTOMOBILE DRIVING GEAR.—J. HETTRICH, P. O. Box 664, Lincoln, Neb. The purpose here is to provide a direct driving connection between the motor and the wheels, so connected that there will be no interference with the steering mechanism, and wherein the differential connection of the wheels is independent of the axles.

VEHICLE WHEEL.—J. W. CALTA, Platte, S. D An object here is to provide a device to take the place of a wheel provided with a pneumatic tire. This device has all of the advantages of the pneumatic tire, but is not as costly as the latter. Further, the object is to provide a wheel having a combined spring and pneumatic action, which results in a wheel having admirable riding qualities.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12669) R. T. asks: Could you name a substance that would stop completely the attractive action of a magnet? A. There is no material known which can stop completely the attractive action of a magnet. Magnetism passes through everything with considerable ease. Through iron and steel it passes with much greater ease than through the air and other common things. For this reason you can surround a magnet with a heavy casing of soft iron, and the magnetic lines will go around the magnet in the iron instead of leaving the iron and passing through the air inside the shield. This is the nearest to a magnetic shield that can be had.

(12670) A. H. W. says: Which is the better non-conductor of heat, fine wool or a space of equal area and depth filled only with air? If an attempt is made to use a chamber of air as a non-conductor, would it be necessary to make the chamber entirely "air tight?"—that is, altogether proof against egress and ingress of outside air. If an air chamber is used as a non-conductor, is it necessary that the inclosed air be below the temperature of the outside air? A. Heat always flows from bodies of higher temperature to adjacent bodies of lower temperature. "Non-conducting" materials are properly only slow-conducting, since all substances transmit heat in some degree. Dry gases, such as air, are very bad conductors; but if free to circulate in a hollow wall, the molecules of the air carry the heat rapidly by "convection" as they move about the space. For good effect, as heat insulation, air must be confined in cellular spaces, the smaller the better. All effective insulators, as wool or cork, depend for their action on the fact that they entrap large quantities of air in small spaces, so that it cannot circulate readily and transfer heat through the thickness of the insulating wall. It is, therefore, evident that the air should be confined closely, and that it will always be warmer than the cold side of the wall and colder than the warm side.

(12671) E. L. writes: Your favor of July 1st is very disappointing; it brings me up against a stone wall and does not tell me why I cannot climb over it. "An electric motor cannot charge a storage battery." Why not? If you can tell me of any publication that will answer that question, I will take it as a great favor. Funk & Wagnall's Encyclopedia: "Shunt machines are the most suitable for charging storage batteries; . . . the same machine which converts mechanical into electrical energy will serve the opposite function equally well. So I thought, by using one or more switches, the battery might be connected to the electromagnet or switched off to the armature as it was wanted to charge the batteries or to be run as a motor. A. The reason why an electric motor cannot charge a storage battery is that a motor is not a generator of an electric current. It receives electric current from some other source and transforms it into mechanical energy. A motor is often, as you know, capable of being used as a dynamo by applying steam or other power to it to turn the armature. It is then a dynamo and not a motor. All motors cannot be used in this way. Whether your motor can be, may be easily determined by an inspection by an electric engineer, say the engineer of the lighting station in your city. If feasible, you may then provide a gas or other engine for it, or even a small dynamo, which may be driven by your motor and be so wound as to furnish just the current required by your battery. Then, too, there are ways of cutting down the current to the capacity of your battery, and connecting it directly to the line which runs the motor. This mode is likely to be more expensive than to buy a small dynamo and run it with your motor. The statement you quote, "The same machine which converts mechanical into electrical energy will serve the opposite function equally well," is not always true. Many motors cannot be used as dynamos without alterations. No motor can be made a dynamo by simply the turn of a switch. A motor can be made a dynamo only by driving it with external power. A dynamo always transforms mechanical into electrical energy. You will find a much more correct statement of the interchangeability of dynamos and motors in Sloane's "Handy Book of Electricity," which we send for $3.50, as follows: "Electric motors had been constructed for many years before it was definitely decided that the same machine could receive electric energy and convert it into mechanical energy, thus constituting itself a motor, or could be operated by a steam engine, water turbine, or other prime motor, receive mechanical energy, and convert it into electric energy. It then is a generator or dynamo." (Page [illegible].) We hope this statement of your [illegible] is plainer than our first. We simply gave the answer without explanation in the haste of a [illegible] day, but are pleased to amplify it.

NEW BOOKS, ETC.

AN UNSINKABLE "TITANIC"; EVERY SHIP ITS OWN LIFEBOAT. By J. Bernard Walker, Editor of the SCIENTIFIC AMERICAN. New York: Dodd, Mead & Co., 1912. Size, 5¼ x 7¾; 185 pp.; 40 illustrations. Price, $1 net.

The object of this work is to show that during the past fifty years of progress the shipbuilder has been so much occupied in developing the speed and luxury of ocean travel that he has neglected to make the ocean liner reasonably safe. The most startling feature of the loss of the "Titanic" was the fact that she went to the bottom so soon after the collision. Both the owners and the public at large believed that the great ship was practically unsinkable; yet in the brief space of two and a half hours after striking, the "Titanic" sank in 2,000 fathoms. The most important lesson of the disaster is not the need for more lifeboat provision or for more careful navigation, though both are necessary. Reforms should begin with the ship itself, which should be so constructed that in the event even of such a serious collision as that of April 14th, a ship will serve as its own lifeboat, and remain afloat until the rescuing vessels, summoned by wireless, can come to its aid and transfer the passengers.

That such ships can be built is clearly proved by the fact that the first large ocean liner, the "Great Eastern," built over half a century ago, was so carefully safeguarded against sinking that, after running over a submerged rock off Montauk Point, and receiving far more serious damage to her hull than the "Titanic," she came safely to New York under her own steam. It is the object of this work to show that since her day there has been a steady decline in the art of unsinkable construction, and the book is a plea for a return to the principles of subdivision that were embodied in that fine vessel. This is the first time that a book has been written upon this vital subject of the safe construction of ships; and the argument for a reform in present methods and a return to the safe constructions of an earlier day is irresistible. The most vital chapter is one entitled "Safety Lies in Subdivision," in which, by means of diagrams, the various protective devices, such as bulkheads, watertight decks, and double skins, are clearly explained. The chapter on the "Great Eastern" contains a full description of that epoch-making vessel, with drawings and photographs showing her construction, and her appearance as she lay at the foot of Canal Street, New York. It is significant that the changes in ship construction suggested by the author are identical with those proposed, both by the Senate Investigating Committee and by Lord Mersey of the Board of Trade Investigation. In every chapter of the book will be found answers to the hundred-and-one questions which have been asked about this stupendous tragedy; and the author makes it perfectly plain just why this noble ship was lost, and how the recurrence of such a disaster may be rendered impossible.

The half-tones and drawings are admirably executed, the book is ably written, and the interest is sustained throughout. Readers of the SCIENTIFIC AMERICAN need no introductory to the author and to his clear and interesting mode of expression. Mr. Walker is an acknowledged authority on marine and naval matters, and yet his treatment of technical subjects is such as to appeal to laymen as well as engineers. As an excellent example of his readable and entertaining style, we need but point to the series of articles on target practice, which appeared in the SCIENTIFIC AMERICAN last fall, under the title of "The Log of a Landsman Aboard the Battleship North Dakota."

THE ART OF THE BERLIN GALLERIES. By David C. Preyer, A. M. Boston: L. C. Page & Co., 1912. Large 12mo.; 324 pp.; illustrated with full-page plates in duogravure. Price, $2 net.

Mr. Preyer's new volume concerns itself chiefly with the collection of the Kaiser Friedrich Museum, with a much briefer description of the nineteenth century paintings of the Royal National Gallery. The method followed in regard to the Kaiser Friedrich has been to give the Italian, Spanish, French, English, German, and Dutch-Flemish schools each a section of critical description, illustrated by fair reproductions of the more noteworthy canvases. The museum, while boasting comparatively few masterpieces by famous names, possesses such a broad, comprehensive stretch of work typical of schools and periods that its lessons are of the highest educational value. The Royal National Gallery, founded upon the 262 canvases bequeathed King Wilhelm by G. H. W. Wagener, has grown to 1,100 paintings, 333 sculptures, and 30,000 drawings and water colors, mostly by German artists. Among the mentionable plates of this section are the pleasing "Springtime in Ehringsdorf" by Karl Buchholz, the "Spring Day" of Böcklin, and the portrait of Mommsen by Franz von Lenbach.

THE GASOLINE AUTOMOBILE. Its Design and Construction. Vol. I. The Gasoline Motor. By P. M. Heldt. New York: The Horseless Age Company, 1911. 8vo.; 508 pp.; illustrated. Price, $4.

Mr. Heldt, prepared and fortified by eleven years' experience as editor of *The Horseless Age*, has given us an impressive work on automobile engineering. The first volume covers with much thoroughness all the elements, parts, and principles of the gasoline motor—the media through which it works, the laws of gases, the cycles, the conversion of reciprocating into rotary motion, the balancing of engines, and the oiling and cooling systems. Each important part of the motor is treated in a separate chapter, with profuse diagrams and succinct description. Motor testing, with the necessary indicators and apparatus, is also given a full and well-written explanation, and the resultant diagrams are shown, demonstrating out-of-phase crank motion, pre-ignition, late ignition, and slow combustion of ignited charge. In addition to photographic views of five modern motor equipments, a pocket in the back cover contains a book of valuable plates showing sectional diagrams of twenty standard makes of automobile engine. Mr. Heldt's volume is perhaps as well entitled to the adjective "exhaustive" as any other American work on the subject.

CHILE AND HER PEOPLE OF TO-DAY. An Account of the Customs, Characteristics, Amusements, History, and Advancement of the Chileans, and the Development and Resources of Their Country. By Nevin O. Winter. Boston: L. C. Page & Co., 1912. 8vo.; 411 pp.; illustrated. Price, $3.

Chile, the foremost maritime country of South America, well repays a thoughtful study and forces some optimistic prophecies of a greater future. With an extensive seacoast indented by splendid harbors, with mild climate, broad, fertile valleys, fine grazing grounds, and vast mineral wealth, it is physically favored beyond its sister nations. The strain of Araucanian blood gives to the national character a free, proud independence and a soldierly efficiency that must eventually combine with the natural resources to place Chile in a commanding position both on land and sea. By map, illustration, and sympathetic yet keen-visioned description, Mr. Winter places before us a vivid conception of Chile and her people, their activities, customs, aspirations, and present achievements. Among the appendices are some suggestions for travelers that, although brief, will conduce to the comfort and convenience of intending visitors.

GOD AND DEMOCRACY. By Frank Crane. Chicago: Forbes & Co., 1912. 16mo.; 72 pp. Price, 50 cents.

Whatever else they may lack one may always find in Mr. Crane's little preachments the vitality of optimism. He himself defines the scope and the limitations of "God and Democracy" when he says it is not a book of exhaustive argument, but of pointed suggestion. The dissertation seeks to show, in a reverent manner, how the idea of Democracy is altering our idea of God. The modern conception of God is less that of the Universal Ruler, and more that of the Universal Servant. Service is exalted above rule, and service, the writer believes, is for the first time in history acquiring a proper appreciation. "The greatest thing in the world is to serve."

THE CORONA COOK BOOK. A Collection of Choice Recipes with an Expansible Device for Keeping Personal Cooking Rules. By Ruth Alden. Chicago: The Abbey Company, 1911. Price, $1.25.

Strictly speaking, this is not a book at all, but a little box cunningly made to imitate a book, and containing recipes on separate cards, the subjects being self-indexing after the approved modern card-index system. Extra cards are provided, on which new or favorite recipes may be copied or pasted. Altogether it is a most convenient way in which to keep the recipes most frequently referred to, as any card may be taken from the box for ready use, and returned after its directions have been followed. The dishes furnished with the outfit are economical and nutritious combinations of plain and wholesome ingredients.

CRIMINAL PSYCHOLOGY. A Manual for Judges, Practitioners, and Students. By Hans Gross, J. U. D. With illustrations. Boston: Little, Brown & Co., 1911. 8vo.; 514 pp.

Hans Gross is probably the foremost criminal psychologist in Germany. He has had the practical experience of a criminal lawyer and a criminal judge in writing a book which is a marvel of erudition. The volume before us is a remarkable effort to produce what may be called a pyschological system which can be practically applied hy criminal judges and lawyers. The deposition of witnesses, perception, superstition, probability, illusions, lying, mistakes, and isolated influences—all of these are considered from a criminological standpoint. Crimes are of such complex nature as to demand the systematic diagnosis of the criminal. Heredity and environment, associations and standards, initiative and suggestive ability all play their part. The judge or the lawyer who knows nothing of psychology, and only his criminal law, must flounder about hopelessly when confronted with the complex issues in which these factors play their part. Who but a psychologist can distinguish between hallucination and lying; between a superstitious believer in the reality of an experience and one suffering from an actual hallucination? Whatever may be the opinion of lawyers and scientific men as to the value of scientific aid in administering judgment, Prof. Gross firmly believes in the value of criminal psychology. This work may be accepted as the most authoritative book of its kind. Indeed, it was the first really objective criminal psychology which dealt with the mental states of judges, experts, jury, witness, and criminals.

PRACTICAL CEMENT WORK. An Elementary Treatise on Cement Construction. By W. B. Henry. Atlanta, Ga.: The Concrete Age Publishing Company, 1911. 16mo.; 110 pp. Price, 50 cents.

"Practical Cement Work" is a little treatise which those newly interested in any form of this construction will welcome. It gives the simple fundamental principles of form building, waterproofing, coloring, and testing, tells how houses are built by this method, recites the processes of water and steam curing, and concludes with directions for making sidewalks, and floors for cellars, basements, and stables.

ASTRONOMY FOR ALL. By Bruno H. Bürgel. Translated from the German by Stella Bloch. London, New York, Toronto, and Melbourne: Cassell & Co., Ltd., 1911. Illustrated. 346 pp.

The author of this book, Bruno H. Bürgel, is a self-taught writer on astronomy and a pupil of the self-taught popular scientific writer, M. W. Meyer. Like his master, Bürgel has performed a useful work in emphasizing the more fascinating side of astronomy, and thereby awakening an interest in a science which cannot have too many devotees. His career is interesting. An eclipse of the moon, which occurred when he was thirteen years of age, aroused in him an undying interest in astronomy. His parents, however, were not in a position to gratify his desire for a university education. He was apprenticed to a cobbler and later to a printer, "where," he states, "I hope to get a chance to read much in order to educate myself." His first chance to study astronomy practically came when he received an insignificant post on the staff of *Urania*. Turning now to Bürgel's book, we find it written in a simple, sometimes even in a poetic vein. The chapter on Mars accepts the Lowell theory of the Martian canals, and even quotes with approval the statements of Flammarion and Klein, that Mars is inhabited. In the chapter of the sun, we find a little misinformation that ought to have been corrected. The sun motor in Pasadena, California, proved far less economical than the author states, and is now dismantled, we believe. Nothing is said of Hale's wonderful work with the spectro-heliograph. On the whole, for a good, popularly written book, this "astronomy" can be commended.

THE HELICOPTER FLYING-MACHINE. An Account of Previous Experiments, Including an Analysis of the Author's Turbine Machine, with Theory and Deductions. By J. Robertson Porter. London: "Aeronautics," 1911. 12mo.; 80 pp.; illustrated.

The ordinary types of direct-lift flying machines are characterized as efficient in weight lifting, but very unstable, and the main reason for this instability is charged to the fact that while one blade of the screw is advancing against a current of air, the opposite blade is at the same time traveling with the current, the resultant reaction of the blades thus failing to balance each other. To overcome this defect the author advocates the utilization of the turbine principle, in which the air set in motion by the rotating blades is directed downward by fixed deflecting surfaces, the pressure against the top fixed surfaces accomplishing the lift. Much of the work is merely speculative, and the experiments are shop tests made under not the best of conditions, but the determination of efficient curves, and some of the other formulæ and suggestions, should prove useful to experimenters in, and designers of, helicopter machines.

MODERN AMERICAN TELEPHONY. Edited by Arthur Bessy Smith. Chicago: Frederick J. Drake & Co., 1911. 12mo.; 790 pp.; illustrated. Price, $2.

The purpose of the manual is to help all whose duties call them into relationship with the theory, science, and art of telephony. After some preliminary explanation of the theories of sound and of induction, and of the application of principles in the transmission of spoken words, the reader is made familiar with the various circuits and systems, the battery equipments, magneto switchboards and switchboard installation, standard multiple switchboards, and testing apparatus. In the chapter on "Telephone Troubles and How to Find and Remedy Them," the difficulties most frequently encountered are cited, and all possible causes are given. Line and conduit construction, wireless telephony, and automatic switching are also made the subject of careful exposition.

STABILITY IN AVIATION. An Introduction to Dynamical Stability as Applied to the Motions of Aeroplanes. By G. H. Bryan. New York: The Macmillan Company. 192 pp. Price, $2.

Dr. Bryan attracted our attention by some striking contributions to *Nature* on the mathematical side of aerodynamics. The paper which he read before the British Association for the Advancement of Science aroused a very lively discussion, not all of which was favorable to Dr. Bryan. It is the general tendency to regard the flying machine as a shining example of an invention produced by practical men and not by scientists. There can be no doubt that the work done by the Wright brothers was far more scientific than most aviators are willing to acknowledge. At all events, even if the flying machine is the product of unmathematical reasoning, that is no reason why the aeronautical engineer of the future should not apply to his profession the same knowledge of mathematics which has come to be indispensable in other branches of engineering. It is the purpose of this volume to impart that knowledge so far as it affects problems of stability.

The Cream Separator

(Concluded from page 113.)

of Stockholm, Sweden, was one of the first inventors to confine himself to the development of the dairy separator. His inventions included mainly improvements in gearing, bearings, and shape of bowl. The company which worked his inventions early attained considerable success in the commercial field. It secured the ownership of the Houston and Thompson patent, and De Laval improved on it, and converted the raw idea into a practical machine. Ten years later, on the assignment to the company of the Bechtolsheim liner patents, the company secured an almost absolute monopoly in the manufacture of dairy separators.

Since the invention of the liner, progress has been steady and rapid At first the makers were so flooded by orders from creameries that they could not turn their attention to the improvement of the separator for other than creamery purposes The hand separator involved a number of problems not found in the power separator, but they were problems for the machine designer rather than for the inventor.

The hollow bowl separator is still in extensive use. For farm purposes, it possesses some striking advantages over the liner machine Its ease of operation and its few parts, making cleaning easy, commend it to many people. The modern hollow bowl is a long slender tube with a skimmer at the top. The liner separator, however, despite its defects, has the field. It is exclusive in the creameries Of the many farm separators on the American market, all but one are liner machines, and the majority of these belong to the disk type, described in detail in the original liner patent This consists of a number of dished steel plates spaced apart and secured to rotate with the bowl. The milk is fed rapidly outward and is separated between the disks. The central core is a hollow slotted tube which serves both to convey the milk and to support the liner plates. Besides the disk, there are a dozen or more other types of liners, and these are susceptible of an infinite number of modifications, many of which are in actual use. Much serious study is being spent in working out the mechanical adjustment of the most efficient liner possible Theoretical results are very difficult to demonstrate because even with perfectly transparent bowl and liner, it is difficult to determine the exact movement of the currents on account of their extreme rapidity of movement. Much of the work is being done by salaried experts in all of the larger factories, which have the equipment and funds necessary for carrying on the work.

The three problems of most importance are the problem of properly feeding the milk into the bowl, the regulation of the skimmer, and the cleaning problem. With or without the liner, the milk forms a hollow column in the rotating bowl. The richest cream is at the inner wall of the column, and the richness decreases toward the outer wall. Somewhere between center and circumference is the best point for applying the full milk. The direction of movement of the full milk on entering the bowl will manifestly have an effect on the efficiency of the machine The skimmer, too, is susceptible of improvement. Usually some form of hollow screw on an eccentric axis is used By turning the screw the richness of the cream can be regulated At present, however, there is no satisfactory way of making the adjustment while the machine is in motion The cleaning problem, while seeming to be simple, is in fact difficult and important. The bowl slush left in the separator contains much cheesy matter This is difficult to remove with cold water and impossible with hot water. In the presence of water, hot or cold, it acts much like eggs, and when the liner is a complicated one, the cleansing involves as much work as dish washing after a large meal. The slush is an excellent breeding place for undesirable germs, and unless the cleansing is thorough, the next charge of milk is liable to become badly tainted. This usually means a money loss to the farmer since creameries grade their cream and pay for it accordingly. So serious is this trouble that separator cream is seldom equal in flavor to hand skimmed cream. The solution of this problem would be worth a fortune.

When the farmer has six or more cows, and sells either cream or butter, the separator pays handsome dividends on the investment. The saving in cream alone over the older methods will do this. The whole milk can be separated immediately after being drawn, instead of waiting from twelve to twenty hours. The farm separator has also an advantage over the creamery separator. Instead of daily trips, it means one or two trips a week, or better still, the cream can be taken along when another errand takes the farmer to town. The skim milk, instead of being left at the creamery or coming back with possible contamination of disease germs from other herds, is fed to the stock while still warm, and in its best possible condition. The farm separator has come to stay because it is a money maker for the farmer, and properly handled, it should be an important factor in conserving the fertility of the soil.

One of the difficulties in the way of complete separation of milk is the affinity of the small particles of proteids and oil for one another. Prof. Babcock made use of the fact that the proteids can be digested and dissolved in sulphuric acid, thus leaving all particles of butter fat free in a medium for which the particles have little or no affinity. He designed a compact and portable centrifuge, and test tubes so graduated that the proper proportion of milk and sulphuric acid could be introduced. The percentage of butter fat is indicated on direct reading. The method, because it enables even the most unskilled worker to make reliable tests, has superseded the old cumbersome laboratory methods, and is now in almost universal use in all countries where dairying is carried on.

The Motor Contest at Winnipeg

(Concluded from page 113.)

economy test. This was taken advantage of by some competitors who held their engines to as low a power output in the two-hour test as was consistent with economy, and then, with the fuel penalty removed, ran at the highest possible horse-power in the half-hour test. There were no points given on output of power in comparison with piston displacement, hence in one or two cases engines which had made very creditable showings from the practical standpoint, failed to get proper recognition

In the plowing tests a field of 240 acres had been secured 12 miles from Winnipeg, and intermittent, happy-go-lucky train service enabled the competitors and visitors to reach the spot. The furrows were three fourths of a mile long, and each engine made a total of six miles, regardless of the number of plows pulled This consumed from two and a half to three hours of actual plowing for each engine in addition to stops and turns. The field was not as smooth and uniform as had been secured in previous contests, consequently the draft of plows varied considerably more than the actual differences in the plows would account for. On the whole, the draft was much heavier than in any previous contest, and it is interesting to compare the figures of close to 900 pounds per 14-inch plow, $3\frac{1}{2}$ inches deep, with the ordinary figure of 400 to 500 pounds for the same plow twice as deep in Illinois and Iowa

Recording dynamometers gave the average draft very accurately, and an observer accompanied each outfit to get accurate data on the time, stops, condition of engine, and any other points which had bearing on the performance of the outfit. Careful measurements were taken of the fuel and water consumed in relation to the horse-power developed and the acres plowed. The score card was so arranged as to encourage the development of as high a horse-power as possible, consistent with economy, but no maximum test on the drawbar was included. The drawbar horse-power developed, therefore, is probably nearer the economy load in most cases than the maximum. This was illustrated by the larger Rumely tractor, which was used again in the engine gang-plow competition. It developed only 34.4 tractive horse-power in the engine competition and 42 in the plow competition, pulling a larger number of plows then because there was no penalty for fuel consumption. Points were given for the number of acres plowed per hour in comparison with the horse-power developed in the economy brake test, and this was another element tending to keep the showing on the economy run down to as low a horse-power as would still give economical results.

Another factor which seemed hardly correct, was the scoring of the engines on the distance traveled, or acres plowed, without replenishing fuel and water. The scoring was done simply on the percentage of the tank capacity which was used, and did not consider that only in very few instances could any tractor exhaust its supply of water before running hot. In the case of a steam tractor a certain amount of water must be retained in order to keep the crown sheet covered, and in the case of practically every internal-combustion tractor, not more than 10 to 25 per cent of the total water capacity could be used without causing difficulty.

Following the engine competition was a rather elementary contest for engine gang plows. Instead of making short rounds which would require considerable turning, and give the plowman a real opportunity to show up his gang, only one round was plowed and that of the same length as in the engine competition. It was found afterward that a portion of the points in the score card would have to be omitted on this account. Five companies had entered plows, but only three competed. One withdrew early, and another at the last moment, after the decision to plow but one round had been announced. The Avery Company won in the above classes with their self-lift plow, the Rumely plow being second, and the gang made by the J. I. Case Plow Works (not identified with the J. I. Case Threshing Machine Company) third.

The competition drew the usual gallery of visitors of all classes, although the contest each year is becoming of greater interest to the technical men and less to the farmer. One of the latter exclaimed, when he saw the engines working on the plowing field, "Why, that's just the same as we do at home." To the engineer, however, these contests afford a great opportunity to uncover his own hand for the sake of seeing what progress is being made by his competitors. The competition brings the most prominent men of this stamp together, and at least once a year the progress of the industry is thoroughly reviewed. There is no question that indirectly the results have thus been of enormous value to the farmers of the world. There is a striking contrast between the easy certainty with which the tractors and plows now perform their tasks, and the scenes at the first few contests.

There is considerable agitation in favor of having a motor contest in the United States, but it is out of the question for the average manufacturer to spare his valuable men for more than one such occasion in each year. So long as Winnipeg, having the advantage, clings to her opportunity, just so long does it seem certain that once every year the eyes of the traction engine world will all be turned toward this magnificent city of the Northwest.

A Sahara Sea

(Concluded from page 114.)

of fertility except moisture; also that there exist plentiful underground streams and reservoirs. Now, if these crystal supplies were brought to the surface through hundreds of artesian wells and properly irrigated through the land, supplemented by artificial reservoirs to conserve the precious waters of the occasional rains, ample resources thus exist in the Sahara itself for bringing about future conditions of fertility such as have been

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No 9260. Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9261. Wanted a manufacturer to make card games.

Inquiry No. 9262. Wanted to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Inquiry No. 9263. Wanted name and address of manufacturer of pantaloon stretchers with clamps, which is capable of being folded up.

Inquiry No 9264. Wanted the name and address of manufacturers of date pitting machines.

Inquiry No. 9265. Wanted the names and addresses of manufacturers of machinery for making picket fences.

Inquiry No. 9266. Wanted to buy machinery for fastening wire cloth to wooden frames with coppered tacks.

Inquiry No. 9267. Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9272. Wanted names and addresses of engravers and mounters of fine quality maps or plans of large cities. Large order.

Inquiry No. 9273. Wanted to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9274. Wanted the name of a manufacturer of a machine to make cushion covers for fruit crates.

Inquiry No. 9275. Wanted name and address of manufacturer of stock patterns of platen job printing presses.

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00.

Inquiry No. 9277. Wanted a machine for packing dry batteries.

Inquiry No. 9278. Wanted a machine for separating crab meat from the shell.

Inquiry No. 9279. Wanted a machine for shredding asbestos board.

Inquiry No. 9280. Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears.

Inquiry No. 9281. Wanted to buy machinery for bleaching walnuts and ivory nuts.

Inquiry No. 9282. Wanted name and address of manufacturer of coin-controlled [illegible] for automobile use.

[illegible] in formerly arid regions of the [illegible] States.

Many schemes for irrigating the Sahara have been discussed. The old project, first broached by the French engineer, Col. Roudaire, and indorsed as entirely feasible by De Lesseps and other competent authorities, has never been utterly cast aside. To let in the waters of the Mediterranean to flood the most sunken portions of the Algerian Sahara and thus render fertile large tracts of otherwise barren sand" would not by any means change the whole desert into a vast inland sea, as so many people have imagined, nor in the least affect the climate of Europe, since only some 3,100 square miles of territory, in the form of two distinct lakes in central and southern Algeria, would be drenched.

Prof. Etchegoyen, however, wishes to construct a deeper and longer canal so as to flood a much more extensive tract of desert. But it should be remembered that, since by far the greater part of the Sahara is from seventy feet to more than a mile in elevation above ocean level, and those tracts which lie below ocean level are chiefly valleys between the hills and mountains or the basins of ancient lakes never very extended in area, a Sahara Sea would consist only of an exceedingly irregular body of water containing many islands and extending into the unflooded districts in a multitude of bays and coves. It would be considerably less than one third the size of the Mediterranean. The reported "one half" is somewhat exaggerated.

Now arise the various questions of what important effects such a sea would produce upon the earth. Without discussing further any political or economic influences, there is still much to consider with respect to its possible physical influences. At last, in the progress of human achievement, mankind fears the power of its own ingenuity.

The writer feels that this alarm can be happily allayed, so far as a Sahara Sea is concerned. We are warned that "by the displacement of so many billions of tons of water, the equilibrium of the earth would actually be affected." Let us figure it out. Suppose the Sahara Sea should have an entire area of 250,000 square miles (thus allowing generously for any doubtful regions of desert that might become flooded) and a mean depth of 200 feet. Since one square mile contains 27,878,400 square feet, this entire area would contain 6,969,600,000,000 square feet and 1,393,920,000,000,000 cubic feet. Division of this sum by 40 (the number of cubic feet displaced by one ton)—the result is 34,848,000,000,000 tons of water required to flood the Sahara as suggested. If the canal to admit this water were cut through the north coast of Africa, these thirty-five thousand billions of tons of water would flow in from the Mediterranean Sea, and at the same time the Atlantic waters would flow into the Mediterranean until a level was again established. If the canal were cut to the West African coast, water from the Atlantic would flow directly in, without visibly disturbing the Mediterranean. In either case, the process would be gradual; the flooding of the desert would not be a sudden, precipitous inundation.

Of course, 34,848,000,000,000 tons is a great deal of water. But compare its volume. In that little curve of the Atlantic Ocean which forms the coastline of the New England States and New Brunswick and part of Nova Scotia, there is an area just about equal to the product of 500 by 500, or 250,000 square miles—the same area allowed above for the Sahara Sea. There is a daily tidal rise in this locality varying from about ten feet along Cape Cod to sixty feet in some parts of the Bay of Fundy. Allowing a mean distribution of 20 feet rise, the number of tons of water thrown upon these shores twice every day is fully one tenth as many as would be required to form a Sahara Sea. No one ever fears that this tidal displacement of water will "unbalance" the earth, or in the language of science, disturb the obliquity of the ecliptic. Thirty-five thousand billion tons, in proportion to the bulk of the earth, is utterly infinitesimal. In proportion to the volume of the ocean it is as a drop out of a pailful. And it is proposed to spread out this slight burden of displaced weight over a region nearly at the equator. A little further reasoning, or experimenting with globes or balls, will show that, since the earth is not exactly spherical but is somewhat thickened at the equator and flattened at the poles, to disturb her present axis of 23½ degrees inclination it would be necessary to apply additional weight at either one of the two poles. Additional weight spread out at the equator could not affect the balance of the axis.

We are also warned that the climate of Europe would be endangered. That is a more interesting, because more plausible, objection. At present there is very little rain over the desert region of North Africa. Scientists agree that this dryness is due not to the arrangement of neighboring mountain ranges but to various physical causes in the region itself. Perhaps the presence of so extended a body of water might produce rains. Certainly it would equalize the temperature so that there would be less intense heat by day and less intense chill by night; but comparison with other regions bordering upon seas in the equatorial zone shows that it could not reduce the temperature of a tropical climate to that of any merely temperate region not influenced—as Bermuda is, for example—by warm winds or currents. That eliminates one of the assumed dangers. The warm climate of the British Isles is due to warm ocean currents which sweep their shores; it is most unlikely that drawing from the Atlantic Ocean the water required to form a Sahara Sea would deflect, to any serious degree, if at all, any of these great currents. That eliminates another danger. The third and last danger that has universal import consists in whether or not such a sea would too greatly cool the winds that blow from Africa across the Mediterranean to southern Europe. Paragraphs might be written in discussing this interesting point, in telling how the winds originate in this region, the direction and influence of the trade-winds, etc. But it is safe merely to predict that while colonists living upon the shores of the Sahara Sea would doubtless delight in any cool zephyrs that might blow from its surface around their homes, there would be no appreciable change in the "Afric breezes" that blow across the Mediterranean. Why, the Sahara Sea would be merely a big shallow pond, an unusually large irrigation reservoir, compared with the natural seas and great lakes of the world!

It should be remembered that if France reclaims the desert, she will do so for her own benefit. For several years Algeria has been to France what Florida is to New England during the winter months—her mainstay for all kinds of early vegetables. The green produce, leaving Algiers at noon, is unloaded at Marseilles in the afternoon of the next day, starts on the evening trains for Lyons and Paris, and within thirty-five to forty hours after leaving Africa is on sale in the Paris markets. It was this proximity that first attracted her attention to Africa. At the same time she is not likely to permit the carrying out of any scheme which could injure the climate of southern France and destroy the revenue of her noble vineyards.

The American Road Congress

MANUFACTURERS of road materials and machinery will have an opportunity to display their models before the very men they are most desirous of reaching at the American Road Congress, which is to be held on the Million Dollar Pier in Atlantic City, September 30th to October 5th. All the leading highway engineers of the States, counties, and cities have sent word that they will participate in the congress, and many of the States are making arrangements to have special booths at which full information may be obtained as to the development and the needs of each State.

Every type of road will receive thorough attention in the papers, and discussions beginning with the humble earth road and going through all the standard forms of construction, including the modern bituminous roads, brick roads, concrete roads, and all the forms of construction that are now in use.

Contractors who attend the congress will have an opportunity to see the exhibits of all manufacturers with whom they wish to do business, and to mingle with the public officials to whom they will look for contracts. They will hear some practical papers read by prominent contractors.

The Government exhibit, according to an announcement just made by Hon. Logan Waller Page, director of the United States Office of Public Roads and active president of the American Road Congress, will have a complete exhibit on the Million Dollar Pier, which will contain models of all the various types of roads.

The highway departments of all the States in the union will be represented at the Congress, and there will be a comparative analysis of the contract and force account system in road construction. Papers will also be read on the relation of the contractor to the public official.

The site chosen for the American Road Congress, which marks the consolidation of the convention interests of the American Association for Highway Improvement, with all its allied organizations; the American Automobile Association, with all its affiliated clubs and associations; and the National Association of Machinery and Material Manufacturers, will undoubtedly make a special appeal to the more than 100,000 officials employed throughout the country in supervising construction or maintenance of public highways. Many have written to the headquarters of the American Road Congress in the Colorado Building at Washington, to say that they intend to combine business with vacation by spending the week beginning September 30th at the sessions of the congress.

Automobile tours are being arranged by the American Automobile Association from all sections of the country, and many of the legislators and other officials of the various States intend to be present. The principal addresses will be made by President Taft and Gov. Woodrow Wilson of New Jersey.

Preserving Fresh Flowers

IN order to keep cut flowers from withering, the water which they lose by evaporation must be replaced. Hence the stems are placed in water, the absorption of which may be facilitated by cutting the end of the stem to a wedge shape and thus increasing the absorbent surface. The same effects are produced to a still greater degree by crushing with a hammer an inch or more of the stem.

After a time the wound becomes covered with products of decomposition, due to the presence of bacteria, which impede the absorption of water, especially if the air of the room is warm and the section is not sharply cut. It then becomes necessary to cut off the diseased part of the stem in order to lay bare the mouths of the capillary vessels.

According to *La Nature*, the life of cut flowers can be prolonged somewhat by substituting distilled water for river water. Hot water also gives good results, especially with fleshy plants like hyacinth and narcissus. When the flowers, kept in ordinary water, begin to fade, the bottom third of the stalk is immersed in very hot water. As the water cools the flowers resume their natural degree of stiffness. Before they are replaced in fresh water the portion which has been immersed in hot water should be cut off.

Various antiseptics are sometimes added to the water in which flowers are kept. The addition of a few pieces of wood charcoal retards putrefaction, but it is still necessary to change the water every five or six days.

Soap is employed as a preservative in the following manner: The flowers are first sprinkled lightly with fresh water

...are then placed in a vessel containing soapy water. Every morning they are taken out and completely immersed in pure water for two minutes. They are then sprinkled again and their stems are replaced in the soapy water, which should be changed every three days. It is asserted that flowers can be kept at least a month in this way. In another method the washings are omitted but the soapy water is changed daily. The solution is prepared, in quantity, by dissolving one ounce of white soap and one tenth ounce of common salt in one quart of water, and adding a little pulverized borax.

Sugar is also recommended as a preservative. The best results are obtained by dissolving in each quart of water about five ounces of sugar for pinks, three ounces for roses and six ounces for chrysanthemums. Good results have been obtained also with sodium carbonate (washing soda) and with ammonium chloride (sal ammoniac). The last named salt, however, alters the delicate tints of some roses.

In general, flowers which are to be kept long in water should be gathered early in the morning and in the state of buds about to open, and the stems should be immersed for two thirds of their length. In order to retard evaporation, the room in which the flowers are kept should be heated and ventilated as little as possible.

Evaporation can be prevented by covering the petals with a varnish made by dissolving 20 parts by weight of light copal, previously mixed with an equal weight of fine sand or pulverized glass, in 500 parts of ether. The flowers are dipped in this solution four or five times at intervals of ten minutes in order to allow the ether to evaporate. Flowers treated in this manner retain their freshness and beauty for a long time.

Finally, the following method is generally recommended for preserving flowers, and roses in particular, for long periods. A tin box is partly filled with very fine and perfectly dry salt (dried over a fire if necessary). The buds are laid on the bed of salt so that they do not touch each other, and the box is filled with salt and hermetically closed. If the dried buds are taken from the salt at any time within several months, and their stems are cut and placed in water, they gradually resume their original freshness and open.

A glass-stoppered jar filled with alternate layers of violets and salt, and kept at a moderate temperature, may be employed to perfume a room at any time after two weeks, and retains its fragrance many months, if not opened too frequently.

The Current Supplement

THE SUPPLEMENT, No. 1910, brings a number of good articles this week. Prof. Diaz-Ossa, of the University of Chili, is peculiarly qualified to speak to us on the manufacture of Chili Saltpeter. —The description of a recently installed museum devoted to animal life underground will interest our biological readers.—Dr. Steinmetz, famous for his work in electricity, addresses us this time on a question relating to another field of physics, and makes some very interesting reflections on the second law of thermodynamics.—The center-page article is devoted to the remarkable operations in damming the Mississippi for power purposes.—Our metallurgical readers will be interested in an article on the relations of iron, vanadium and carbon in steels.—A description is given of the low temperature laboratory at Leyden, in which Prof. Kamerling Onnes carried on some of his famous work.

Increasing the Visibility of Vapor.—In a patent, No. 1,031,250, Thomas A. De Vilbiss of Toledo, O., presents a method of demonstrating perfumes or toilet waters in which he mixes with the perfume or toilet water an odorless liquid of greater consistency, specifically glycerine, than the perfume, so that the visibility of the vapor produced is enhanced and the moisture of the vapor is retained, and then affects a [illegible]

Studebaker

The Car that Answers Your Every Demand

Is it Price? Studebaker cars are within the reach of even a modest income

Is it Value? Studebaker cars offer more value than double the price can buy elsewhere Equal in quality of material and workmanship to any car made

Is it Popularity? 75,000 Studebaker cars are already on the road and every owner is an enthusiastic booster

Is it Appearance? Note the just pride of every Studebaker owner in the style and good looks of his car

Is it Name? For over sixty years the Studebaker name has been a synonym for the highest mechanical skill and integrity

Is it Simplicity? Studebaker construction is so simple that any member of the family can run a Studebaker as well as an expert. Nothing to get out of order

Is it Comfort? Long easy riding springs, wide, deep seats, upholstering of the softest hand-buffed leather, the best curled hair over finest pillow springs explain the luxurious comfort of the Studebaker

Is it Guarantee? The Studebaker guarantee covers you for an entire year Any part that proves defective in that time is replaced free of charge.

Is it Prompt Delivery? Our enormously increased manufacturing facilities have now reached a point where we can promise prompt deliveries.

Is it Service? *Studebaker service is valid from California to Maine, and the nearest dealer is ready to make good. No writing to headquarters. No wait No argument*

The $750 Studebaker (Flanders) "20" Roadster

Equipped with Top, Windshield, Prest-O-Lite Tank and Speedometer, $830 f.o.b. Detroit

STUDEBAKER CARS

(Nickel Trimmed)

STUDEBAKER (FLANDERS) 20	
Roadster -	$750
Touring Car -	800
Utility Car -	800
Delivery Car - -	800

STUDEBAKER (E-M-F) "30"	
Touring Car - - -	[illegible]
Detachable Demi-Tonneau - -	1100
Roadster - -	[illegible]

See our dealer. You can get prompt delivery. Our Art Catalog E mailed on request.

The Studebaker Corporation Detroit, Michigan

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 7.] NEW YORK, AUGUST 17, 1912 [PRICE 15 CENTS $3.00 A YEAR

A Battleship With Cruiser Speed

The Twelve-gun "Wyoming" Makes Over Twenty-two Knots

IMPROVEMENT in the motive power of ships, and particularly those of large size and power, has been as great in the boiler room as in the engine room—a fact which is too often overlooked. Not all the great *increase which has taken place in the speed of war-ships* during the past few years is to be attributed to the engines. The turbine, it is true, has done much, but superheated steam and the water-tube boiler have had a large share in the improvement.

Take the case of that handsome battleship, the "Wyoming," which recently, on its trial, made a speed of over twenty-two knots on one of its runs and an average speed of 21.828 knots for the four-hour run. The ship is driven by Parsons turbines, working on four propellers, and in the tests they gave the usual good results which we have come to expect from this very fine turbine. On the other hand, it would be simply impossible to supply the necessary amount of steam for the turbines from a battery of the old Scotch boilers. They would be too cumbersome and heavy, and space for a sufficient installation of them could not be found in the "Wyoming" without sacrificing some other necessary element in the ship. The boiler equipment consists of twelve B. and W. water-tube boilers, equipped with superheaters and all the latest requirements of up-to-date boiler practice. The total grate surface is 1,448 square feet, and the total heating surface is 64,234 square feet. The contract maximum horse-power, or in this case, "shaft" horse-power, is 28,000, which was exceeded.

It was only a comparatively few years ago that twenty-one to twenty-two knots was the standard speed for the cruiser. To-day, cruisers of from twenty-five to twenty-eight knots speed are becoming common, and battleships speeds are never less than twenty, and are sometimes as high as twenty-three knots.

The "Wyoming" is an enlarged "North Dakota;" and she embodies improvements which have been made as the results of the experience gained with that ship and her sister, the "Delaware," during the year or two that they have been in commission. The ship is five hundred and sixty-two feet in length over all, ninety-three feet two and one half inches in beam, and her mean draft is twenty-eight feet six inches. The full-load displacement is twenty-seven thousand, two hundred and forty-three tons. The contract speed was 20.5 knots, which she has, therefore, exceeded by nearly one knot. The displacement on trial was twenty-six thousand tons. The bunker capacity of the ship is 2,500 tons, but she also can carry four hundred tons of oil fuel.

The "Wyoming," and her sister, the "Arkansas," are the first battleships in our navy to mount twelve twelve-inch guns. The distribution of this battery is similar to that on the "North Dakota," but with an additional turret. It is mounted in six turrets, all on the center line. Two of these turrets are on the fore-castle deck, and the other four are on the main deck.

The arrangement of the turrets in three superposed pairs is symmetrical and adds greatly to the handsome appearance of these ships; in fact, we do not hesitate to pronounce them the most shapely super-dreadnoughts which are now under construction for any navy of the world.

The twelve-inch guns are of the new fifty-caliber type—a most handsome piece of great power, accuracy, and rapidity of fire. When it is fired with its maximum velocity of twenty-nine hundred and fifty feet per second the energy is 52,483 foot-tons. Because of erosion difficulties, it is not likely that this velocity will be used in actual service. Probably the service charge will give about 2,750 feet per second. The secondary battery consists of twenty-one five-inch, fifty-one caliber guns, so mounted that eleven guns are available on each broadside.

The armor plan shows a belt at the water line which is eleven inches at the top and nine inches at the bottom. Above this is another belt of armor fifteen feet deep and from ten to eight inches in thickness. The turrets and barbettes carry ten to twelve inches of armor.

The United States Navy may, in the future, build more powerful ships, but it can hardly produce a more handsome one than the "Wyoming."

Preventive Clinics in Industrial Establishments

THE only way to interest the manufacturer in the health of his employees is to prove to him that it pays in dollars and cents to improve factory conditions. When his profits are obviously affected, he is likely to be interested in the welfare of his employees, as a general rule. Some of the larger corporations, however, have reached a stage where they regard the health of their employees as they do their own, not from a mercenary point of view, but simply as a matter of fair play.

The whole matter is excellently considered by Dr. James A. Honeij in *The Engineering Magazine*, from which we quote the following paragraphs:

"Increased profit is represented by a more healthy, energetic attitude of the employee toward either his work or the purchasing public. If ventilation, temperature, and humidity are improved, and if an existing physical disturbance is corrected, physical action as well as mental activity must necessarily be greater. In piece work this is apparent. When the market demand is large, and space is limited, it is imperative that the individual piece worker not only be relied upon to produce a certain number of articles, but often he is urged to increase it. Does the atmospheric and physical condition have anything to do with the profits of the employer? Most decidedly.

"In general, then, we can demonstrate the economic basis for a preventive clinic. A case showing the importance of ventilation is cited by C. E. A. Winslow where the New England Telephone and Telegraph Company at Cambridge, Massachusetts, had installed a simple ventilating system in their operating room, in the spring of 1907. Dr. Winslow states the following in his report on the 'Cash Value of Factory Ventilation':

'The change in ventilation did not affect the attendance in the operating room during the summer of 1907. No direct effect could be expected at this season, since in warm weather, with windows open, natural ventilation of the room could scarcely be improved upon. During the winter of 1907-1908, however, a marked improvement was manifest. For the first three months of 1906 the average percentages of operators absent were 4.0, 5.6, and 4.1, respectively; for 1907 the figures were 5.2, 5.0, and 3.4, for 1908 they dropped to 1.8, 2.4, and 1.5. Comparing the three winter months only (January to March), it appears that 4.9 per cent of the force were absent in 1906, 4.5 per cent in 1907, and only 1.9 per cent in 1908. This means a net saving for the three months of 2.8 per cent of the force employed, corresponding to one and eight tenths the entire time of one operator.

'The original cost of installing the system of ventilation was in the neighborhood of $75. The saving in operator's time during the three winter months amounted to 23 working weeks, as indicated above (13 weeks × 1.8). Since the average pay of an operator is $8.50, this meant a saving of $195 to the employees in wages, and the increased efficiency due to the regularity of attendance paid good interest to the company.'"

Another case is cited in which the cost of installing a ventilating system was $6,000; the reduction of the percentage of absences due to illness was so great that the employer was compensated for his outlay; and while previously the employees were likely to become stupid in the latter part of the afternoon, the new system maintained alertness during the entire day.

Length, 562 feet; **beam**, 93 feet 2½ inches. **Mean draft**, 28 feet 6 inches. **Displacement**, 26,000 tons. **Full load displacement**, 27,243 tons. **Speed**, 21.3 knots. **Armament**: twelve 12-inch 50-caliber guns, twenty-one 51-caliber, 5-inch. **Armor**; belt 11 to 9 inches upper belt 10 to 8 inches; **turrets**, 12 inches. **Torpedoes**, two 21-inch, submerged.

"WYOMING"—FIRST 12-GUN DREADNOUGHT OF THE UNITED STATES NAVY

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, AUGUST 17, 1912

Published by Munn & Co., Incorporated Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico Cuba and Panama	
Subscriptions for Foreign Countries one year postage prepaid.	4.50
Subscriptions for Canada one year, postage prepaid.	3.75

The Scientific American Publications

Scientific American (established 1845) . . .	per year,	$3.00
Scientific American Supplement (established 1876) .	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Merchant Marine—Free Canal Fallacy

THE United States Senate by vote of eleven to forty-four has refused to strike from the Panama Canal bill the provision granting free passage through the canal to American ships. The correspondent of the *Times* at Washington is of the opinion that the overwhelming nature of the vote shows that there is no chance that further debate will change the matter before the bill is finally disposed of.

This action of the Senate means that it is the deliberate purpose of that body to violate the letter and, as many of us see it, the spirit of a most clearly-stated treaty obligation.

But it is not of the moral aspect of this question that we are about to write—we did that in our last issue. What we wish now to point out is that in exchange for this playing *fast* and loose with international obligations we are about to obtain a very doubtful compensation. The country is asked to believe that the remission of tolls to American ships using the canal, will prove to be a powerful and very effective agency in building up our defunct merchant marine. As a matter of fact, it will do nothing of the kind. So far as coastwise shipping is concerned, that is already protected; for the ships of *foreign* nations are prohibited from engaging in such trade. To remit tolls to coastwise shipping will be in effect merely to divert a certain portion of the profits of the canal from the National Treasury into that of the shipping companies that are benefited.

Equally short-sighted and fatuous is the belief that the remission of tolls will benefit our deep-sea shipping as a whole, and bring about a general revival of the American Merchant Marine. The causes which underlie the present moribund condition of our over sea trade lie too deep to be reached by any such expedient as the remission of canal tolls. The relief afforded would be too local and limited. Consider, for instance, our trade with South America. The remission of tolls to ships engaged in that trade would mean that those ships which run to South American ports on the west coast would receive the benefit of Government assistance, while those which run to ports on the eastern coast would receive no benefit whatever. On what practical grounds could such a discrimination be justified? Why should our trade to the western coast of South America, to Australasia, and to the Orient be so greatly assisted, and the trade to South American and European ports be left in its present hopeless condition?

The upbuilding of our merchant marine is one of the most complicated and difficult problems that ever confronted the Federal Government. The question should be considered upon broad and statesmanlike lines, and any stimulus that Congress may apply should be of a kind that will go to the very heart of the problem. The external application of a quack remedy (for such is this free-toll movement) will never do more than give a relief that is local and temporary. Our deep-sea shipping as a whole will remain in its present comatose condition.

The gain will be slight. The cost in loss of international prestige and reputation for square dealing (and as a people we have always prided ourselves upon that) will be appalling!

We note that one of the amendments to the bill calls for the admission to American registry of foreign-built ships exclusively owned by Americans. We are not prepared to admit that such admission would be altogether a benefit; but as a means to the end desired, it is infinitely preferable to the original bill.

If the Senate sincerely wishes to promote American shipping, let it do something that is at least statesmanlike and consistent with that high standard of international morality which the citizens of this great republic still fondly believe to be one of our greatest national assets.

Archeology, Sulphur, and Cyrene

GREAT industries have often been associated with the elements of physical danger confronting those who engage to further them. The hazard is ten-fold increased when the operations are carried to, and even beyond, the frontiers of civilization. The history of every great enterprise of European or American capitalization that has spread to remote lands and alien peoples, records death and suffering.

To ascribe to the competition within the zone of civilization of two great industries the untimely death of an American citizen not even remotely identified with those industries and laboring in archeological research on a bleak stretch of North African coast would be to presume upon the credulity of a reader of fiction. But an instance of the truth that is "stranger than fiction" is revealed by the train of circumstances that led to the murder at Cyrene, in Tripolitania, a year and a half ago, of Herbert Fletcher DeCou, of Michigan.

In the columns of this issue of the SCIENTIFIC AMERICAN there is marshaled indisputable evidence to show that DeCou, who was a member of the expedition sent to Cyrenaica by the Archeological Institute of America, met his fate indirectly as the result of the legitimate, but none the less determined, rivalry between the centuries-old sulphur industry of Sicily and the sulphur industry of Louisiana, youngest of America's "infant industries." The evidence also goes far toward establishing the fact that the inordinate Sicilian fear and suspicion born of that industrial conflict was a contributory cause of the present war between Italy and Turkey.

DeCou was plainly an innocent victim of circumstances that, for the most part, operated quite without his sphere of life, but that in an evil hour shifted only to center upon the desolate Acropolis of Cyrene, where he toiled with a scholar's rapt enthusiasm on behalf, not of industry, not of commerce, but of the science of antiquities. His lonely grave on the face of the plateau of Cyrene, "looking out westward, toward the homeland," to quote the description reported to the Archeological Institute of America by Prof. Richard Norton, of Harvard University, who directed the expedition, bears mute, but eloquent, testimony to the fact that the life-risk which attends the onward march of modern industry may, by an abortive sequence of events, find a sacrificial victim even in the pursuer of a totally divergent calling.

How deep-seated was the antagonism which the presence of the American expedition at a point several hundred miles away from the coveted sulphur region of Gebel-el-Gebrit created in certain Italian quarters is to be gauged from Prof. Norton's report of the trials which beset the party in their efforts to obtain an actual start of operations on the site of Cyrene. The Senussi tribesmen whom they employed levied upon them for an exorbitant wage, and concerning this the director observed.

The reason why I agreed to this high rate (10 piasters or about 30 cents a day) was that I wished to convince the Arabs, as soon as possible, of the advantage to be derived from our presence. One reason that they demanded it was that reports had come to them from Benghazi that if they refused to work for us and forced us to depart, our concession would be taken up by Italians, who would pay them one *mejidie* (about $1) per day.

Of noteworthy interest, also, is Prof. Norton's statement that "there is reason to suppose the bullets were intended for the director, and that the purpose was to thwart the undertaking by driving the Americans from the country."

The fact remains that the immediate cause of the DeCou tragedy was a criminal plot against American life and an American undertaking. Suspicion points to Sicilian influence in, if not direct Sicilian instigation of the murder. The current recital of the history of the Sicilian sulphur industry, which has always been closely identified with the political life of the island principality, demonstrates how serious, how vital a menace American control of the sulphur deposits of Cyrenaica must have seemed to the Sicilians. It must have loomed to the stature of economic disaster before their affrighted gaze. In the light, or rather the shadow, of so grave an impending catastrophe, their energetic protests to Rome and the violent utterances of their local press were justified.

Had Cyrenaica been under any civilized dominion, it would have been a relatively easy task for Italy's diplomatic representatives abroad to definitely ascertain whether, as the Sicilians feared, a concession for the exploitation of sulphur in Cyrenaica had been granted to the Americans. [illegible] the excitement of Sicily would have been allayed.

But the Italian Government was dealing with the Porte, whose power and strength have ever been derived from secret intrigue, falsehood and dishonesty. Instead of frankly meeting Italy's rightful inquiry upon the subject, the Ottoman authorities proceeded to make a fancied capital of the suspicion and disquietude of the Italians—to their great cost, as it has since proved. The war followed, and a fearful toll of Arab life is avenging Turkey's deliberate sacrifice of the life of DeCou.

The Use of Ozone for Purifying Air

SOME very satisfactory results have of recent times been obtained by the use of ozone as a disinfectant and deodorizer for impure air, such as has to be reckoned with in crowded halls, in certain industrial workshops and in other places. The use of ozone, however, has its limitations, and in order to successfully and intelligently apply this agent, it is necessary to understand these limitations. The subject is discussed in a paper by M. O. Troy, published in the *General Electric Review*. Experiments on the effect of ozone upon bacterial cultures have shown that the bacteria near the surface of the culture may be more or less completely destroyed, while the deep-seated bacteria are affected but little or not at all. This is only what we should expect, for ozone, coming in contact with the organic material of the culture medium, oxidizes the same, and is at the same time itself reduced to ordinary oxygen. Thus there is no opportunity for any ozone to reach the bacteria in the deeper layers of the medium. As regards more particularly the action of ozone upon impure air, it must be remembered that the ozone will not only attack bacteria and other bodies which it is intended to destroy, but will at the same time act upon all organic matter present, some of which might have been removed by other, cheaper means, such as filtering. It is needless to point out that it is sheer waste to consume considerable quantities of ozone in the oxidation of such removable impurities, to say nothing of the fact that these may take up all the ozone supplied, giving it no opportunity to react satisfactorily upon the substances for which it is particularly intended.

As for the field of usefulness of the ozonizing process, it has already been pointed out that this extends particularly to crowded rooms and workshops. As special examples of the latter may be mentioned, the shops for assorting rags, factories for the manufacture of fertilizers, and those which work gelatine, glue, hides, hair, fat, bones, horn and other slaughter-house by-products. Such installations, the emanations from which constitute a nuisance and a menace to the public health, may with great profit apply the ozone treatment.

Several instances are on record in this country, in which the ozone treatment not only proved a very efficient remedy for conditions of bad air, but did so in circumstances in which other means had failed, or were for some reason inapplicable. Thus a moving picture show in Schenectady had experienced difficulties with its ventilation. The management were very desirous of providing the best ventilation possible, and had gone to considerable trouble in setting up the requisite equipment, but all to no avail. A larger blower could not be installed without giving rise to objectionable draughts. As a solution of the trouble an ozonizer was installed, with the result that the air in the theater is now perfectly sweet and odorless, except for a faint and rather pleasant smell due to the small excess of ozone. Similar results were obtained in a workshop, the air of which was at times rendered uninhabitable by vapors arising from a solvent used in the process of manufacture. Not only was in this instance the desired relief obtained, but a costly system of draught pipes previously installed could now be dispensed with. In another case a store was invaded by clouds of smoke from a fire in an adjacent building, and the owners saw before them the prospect of much loss owing to the difficulty of eliminating the odor of smoke from the rooms and from the goods. Here also, an ozonizer completely saved the situation.

In the sterilization of air, the ozone should be blown into the apartment, or the air should be drawn through a special chamber in which the ozone is mixed with it. It is important that the ozone come freely into contact with each individual particle which it is desired to destroy.

The machine for producing the ozone should not produce any nitrous oxide or any other gas having an untoward action on the human organism.

The generation of ozone should continue until the air, as determined by experimental test, is thoroughly sterilized, and the machine should produce this result without loading the atmosphere with ozone to an injurious concentration.

Engineering

The Bicycle Holds Its Own.—Statistics recently published show that the bicycle is more than holding its own in France. It seems that the total number in that country for 1910 was 2,607,4[illegible], and that this had increased in 1911 to [illegible]. Although, as a means of recreation, the bicycle still survives in Europe only, it is certain that both in the eastern and western hemispheres it has taken a permanent position as a useful means of travel, particularly for the artisan population.

Oil-fired Battleships.—The new battle ships "Nevada" and "Oklahoma," which were recently illustrated in the SCIENTIFIC AMERICAN, are to burn fuel oil exclusively; and naval officers will watch the results of this new venture with keen attention. The advantages are many: fireroom weights have been decreased about 300 tons; there is a decrease in the weight of fuel for a given steaming radius as compared with coal, and there is a decrease in the fireroom force of about 50 per cent. Very valuable also is the saving in the length of space required for the boilers and firerooms. For coal firing 128 feet of the ship's length would be required, whereas with oil firing the length of the "Nevada's" boiler rooms will be only 86 feet.

The Largest Sidewheel Passenger Steamer.—Very interesting is the continual increase in the size of both freight and passenger steamers which is noticeable on the Great Lakes. The new steamship, "City of Detroit III," which is now in commission, is the largest sidewheel passenger steamship in the world to-day. In the history of steamship construction she has only been exceeded once, and that was by the "Great Eastern," which was 692 feet in length. The "Great Eastern," however, was both paddle- and screw-propelled. The "City of Detroit III" is 500 feet over all, 55 feet broad molded, 100 feet over the guards, and she has a molded depth of 22 feet. We shall have more to say on this fine vessel at a later date.

The Clyde and the Diesel Engine.—According to the *London Times*, the Clyde shipbuilders have an objection against the Diesel engine on the ground of its lack of flexibility as compared with the steam engine, claiming that it must be kept running at a fair speed or it will stop altogether, whereas the steam engine can be run either ahead or astern at any slow speed desired. The makers of reciprocating engines of the smaller marine type state that this is the principal reason why the oil motor is not making more headway. But a Diesel engine consumes less than half the amount of fuel and is in every respect far more economical, and hence it is certain that the objection above named will be met and fully mastered; indeed, the reduction gear would solve the problem at once.

German Naval Increase.—At the last annual meeting of the German Navy League, under Admiral von Koster, the president, in his opening speech, stated that the new navy law provided that by 1917 there would be in the navy forty-one battleships and twenty armored cruisers. Yet, in the face of these facts and of our recent emphatic reassertion of the Monroe Doctrine, there is a determined attempt to prevent the construction this year of our moderate naval programme of two battleships per annum. The people of the United States, we firmly believe, are thoroughly in favor of the moderate two-ship program. Taxpayers throughout the country should give their representatives in Congress to understand that the proposed cessation of building is extremely unpopular.

Vehicle and Pedestrian Traffic.—Any one who is abroad on the streets of lower New York at the noon hour—at any hour of the day, for that matter—must feel that the time is near when the question of providing further foot-passenger accommodation is very near at hand. We have frequently advocated the separation of pedestrian from vehicular traffic. The simplest way to do this would be to double-deck the streets, not necessarily across their full width, but by providing above each sidewalk additional sidewalks for foot passengers at the level of the first floor. Apart from the loosening up of congestion which would be secured by this arrangement, the provision of sheltered sidewalks at street level would be greatly appreciated, especially during the rainy weather.

First Voyage of the "Selandia."—An inspection of the Diesel engines of the "Selandia" at the conclusion of her first round voyage (of 21,840 miles) shows that they went through the trial with most satisfactory results. No defects whatever of a mechanical character were developed, and both the navigating and engineering officers speak in the highest terms of the performance of the vessel. The piston rings and the cylinders were found to be perfectly clean; the exhaust valves, according to the engineers, were examined twice and most of them needed nothing more than to be cleaned and ground in. The voyage, says *The Engineer*, has shown that 9,300 tons of cargo can be carried a distance of nearly 22,000 miles on a consumption of 9 tons of fuel for each day of 24 hours. This was done, moreover, with an engine-room crew of ten men and three boys.

Electricity

Wireless in Siberia.—The extreme northeastern corner of Siberia will be in radiotelegraphic communication with Vladivostok by the end of the present summer. Stations are in course of erection at Mayahama and at Novo-Markovo, at the mouth of the Anadyr River.

Shocks from Pole Lines Exposed to Electric Waves.—That high power Hertzian waves emitted by modern wireless telegraph stations are capable of setting up high electromotive forces in metal structures in the immediate vicinity of the stations, was recently shown in Paris. Some workmen on a section of telegraph line experienced severe shocks when they touched the wires. Investigation showed that the source was the great Eiffel Tower wireless station.

Ignition of Mine Gases by Electric Spark.—Many accidental explosions may be traced to the "touching off" of gases by electric sparks. A recent colliery explosion appears to have been caused by the tiny sparks at the trembler contact of an ordinary electric bell; the accident emphasizing the need for providing absolutely sparkless electrical apparatus of all kinds in mines, factories, or anywhere that explosive atmospheres are likely to exist.

Electrical Means of Destroying Marine Boring Worms.—A way has been found to check the ravages of the teredo in destroying wood structures such as the submerged piling of wharves by means of a special floating electric power plant connected to submerged electrodes permanently wired to the wharf. Chlorine gas is electrolytically generated in the salt water, and the chlorine effectually cleans out the colony of teredos which are attacking the wood. An occasional treatment only is sufficient.

The Largest Single-phase Locomotives.—The most powerful single-unit electric locomotives that have been designed up to the present time are now being built for a Swiss railway. These locomotives, ten in number, weigh 108 tons each, total, and have a weight on their ten drivers (adhesive weight) of 85 tons. They are capable of developing 2,500 horse-power at a speed of fifty miles per hour, with a possible increase of speed to seventy-five miles per hour, for an uninterrupted run of 1½ hours, and can exert a drawbar pull of 18,000 kilogrammes from the standstill.

Electrolysis Ordinance in Chicago.—The city council of Chicago has recently passed an ordinance requiring certain electrical equipment to prevent damage by electrolysis. It requires that the difference of potential between any two points on a return circuit must not exceed twelve volts and between any two points on the return a thousand feet apart, within one mile radius of the city hall shall not exceed the limit of one volt, while between any two points on the return seven hundred feet apart, outside of this mile radius, it will not exceed the limit of one volt. Return current amperage on pipe and cable sheaths must not be more than five tenths ampere per pound-foot for caulked cast iron pipe, and eight amperes per pound-foot for screwed wrought iron pipe, and sixteen amperes per pound for standard lead or lead-alloy sheaths of cable.

Wireless Distress Calls Not to Go Unheard.—One of the most noteworthy steps taken during the International Radio-Telegraphic Conference which opened in London June 4th and closed July 5th is the laying down of a practical rule for attendance on the wireless apparatus on shipboard. It will be recalled that the "Titanic's" distress signals went unheard by vessels in the immediate vicinity because the single operator employed on those ships was off duty at the time. Under the Conference rule, a permanent watch is required on ships of the first class, which means that two operators must be employed, and on ships of the second class, employing only one operator, the receiving apparatus must be attended during the first ten minutes of each hour. In order to allow the operator to have his rest unbroken when off duty, this provision will probably mean that one of the crew trained to receive the distress signal, will be required to listen during the ten minutes beginning each hour.

Fusing Platinum in Quartz.—How to fuse platinum wires into quartz tubes, so as to make a good joint, is no small problem. M. Berlemont presented his new method to the Academie des Sciences not long since, and claims to have been successful. The difficulty is that quartz melts at as high a heat as ,800 deg. Cent. and has a very small expansion value, while all the metals expand to a much greater extent and also melt at a lower temperature. After numerous attempts to make a joint, first by direct fusion, and then by an indirect method, such as the use of glass or enamel, oxides or electrolytic deposits between the wire and the quartz, M. Berlemont came back to the direct method of imbedding the metal in the quartz, using a platinum-iridium alloy. By an improved process, requiring some skill, he could make a tight fused joint which would stand a high heat without damage, and was thus able to make all kinds of quartz tubes with fused electrodes.

Aeronautics

Hydro-aeroplanes at Aix-les-Bains.—The municipality of Aix-les-Bains, one of the principle watering places in France, is engaged in organizing a concourse of hydro-aeroplanes with the aid of the Aero Club Flights will be made upon the Bourget Lake on this occasion, from September 14th to 20th, and there will be several prizes, amounting to a total of $10,000. All the flights are to take place on this picturesque lake and the event will no doubt be an attractive one.

A Flying Corps Bill.—The House of Representatives recently passed a bill authorizing the detail of thirty naval officers and thirty army officers for aviation duty at double their regular pay. Officers of the Marine Corps are included in the authorization to the Navy. The length of the detail is made four years, but it may be renewed. It is also stipulated that at any time an officer so detailed may be sent back to his regular duty if for some reason he should become unfitted for flying

A British Aeroplane Gun.—Experiments with a quick-firing gun in an aeroplane were made by the Royal Flying Corps at Farnborough, on July 25th. The test was made in a stiff breeze at a height of about four hundred feet. Some twenty rounds of ammunition were fired at imaginary objects on the plain directly beneath the aeroplane. The recoil is said to have had but little effect upon the steadiness of the machine A biplane was used, built in the army factory. It was especially strengthened in order to carry the weight of the gun and ammunition.

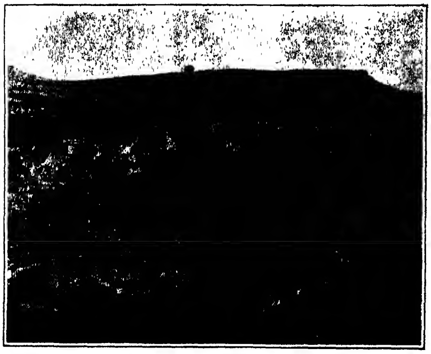
The First Theft of an Aeroplane.—The first case of stealing an aeroplane occurred not long ago at the Puchem aerodrome at Munich. When the pilot, Belat, arrived in the morning he found that some one had broken into his hangar and that the monoplane was missing On inquiry he found that several persons in the neighborhood had heard the noise of a motor about 2 o'clock in the morning. Apparently some enterprising pilot had flown away with the machine. In the suburbs of Munich policemen were kept busy scanning the horizon in search of the flyer. Up to the present writing the machine had not been recovered.

Statistics of French Balloon Ascensions.—Figures show that the number of balloon ascensions in France during the first six months of this year is greater than ever before, this referring to spherical balloons. From January 1st to June 30th, there were made two hundred and fourteen ascensions, for which the amount of gas used was 243,000 cubic meters (7,300,000 cubic feet) The number of persons taking part in these ascensions was six hundred and thirteen, of which there are counted one hundred and twenty-eight officers appointed for the purpose by the War Department, also ninety-seven women aeronauts.

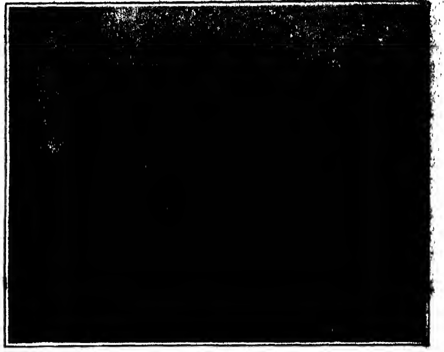
Proposed Aeroplane Flight from London to India.—The Peking-Paris aeroplane flight for which a prize has been offered by the Paris *Matin* has inspired English aviators with the project of arranging a flight from London to India, and a committee has been organized in London to push the scheme The proposed route is across Germany to Vienna, thence by way of the Shipka Pass and Adrianople to Constantinople; then along the route of the Anatolia Railway to Aleppo; thence to Bagdad; thence along the shores of the Persian Gulf and the Arabian Sea to Karachi; a total distance of 4,500 miles. It is expected that at least three aviators will take part.

The Coming French Show.—The fourth international aeronautic show which will be held at Paris in the Grand Palace is likely to outdo its predecessors in interest As to the decoration, it is proposed to use the new aeroplanes which are being built by public subscription for the army. These will be hung in an attractive way so as to make quite an impression upon visitors. It is not certain, however, whether this plan will be realized. As regards the exhibits, these are divided into thirteen groups, comprising spherical balloons and airships, aeroplanes, motors and helices, scientific work and apparatus, works of art, material and machine tools, transport and shelter, maps and books, commerce, various industries and manufactured objects, motor-boats, societies, touring.

Biplanes for Greece.—The fleet of biplanes which H. Farman's establishment delivered to the Greek Government not long since for military use is now engaged in very good flights in that country. More recently, Lieut. Kamberos mounted on one of the biplanes, which was transformed to a hydroplane, set out to make the over-sea flight from Athens to Hydra, the distance being about 50 miles Starting from the port of Phaleros at 9 o'clock in the morning, he sailed above the Salonique Gulf and then rose to a great height and flew toward Hydra in spite of a very stormy wind. The torpedo boat "Nike" accompanied him. He alighted at the port of Hydra, after making the trip in forty-three minutes at an average speed of fifty-five miles an hour, and he flew back to Athens on the following day.



Characteristic scene of sulphur operations at Caltanisetta, Sicily, showing crude product heaped in mounds, ready for shipment.



Molten sulphur pouring from melting furnace into molds at Caltanisetta; Sicilian mine worker "on the job."

Sulphur at Home and Abróad

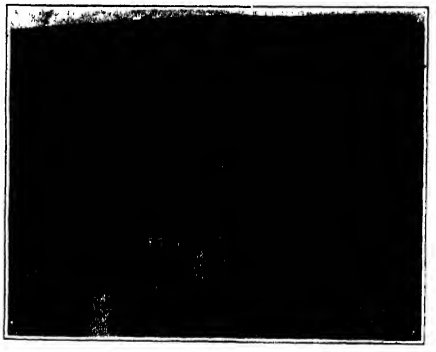
A Contrast Between American and Sicilian Methods

By Harry Chapin Plummer

SICILY'S sulphur production centers in the southerly angle of the island and comprises an area about equal to that of the State of Connecticut. A population of 500,000 is directly dependent upon the industry, and of this at least 350,000 are ignorant, ill-nourished peasants, called "carusi," who labor in the mines.

The minable deposits extend from Centuripe, in the Province of Catania, on the east, to Gibellina (Province of Trapani) on the west, and southward as far as the coast. The richer deposits, all under operation, occur within an area of from 90 to 105 miles in length, and from 53 to 56 miles in width. The sulphur, which in structure is massive, or coarsely crystalline, but usually compact, is found chiefly in an argillaceous limestone, associated with gypsum and bituminous marl. The sulphur-bearing rock takes the form, not of extensive beds, but of immense lenses of variable thickness and richness, and there are usually present from three to four sulphur layers.

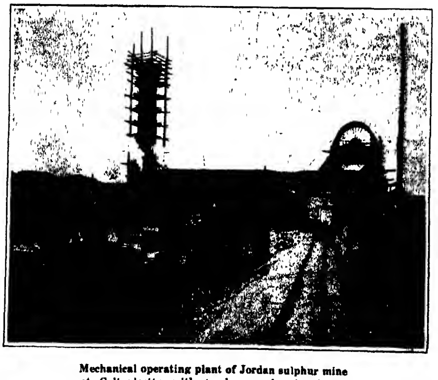
Exceedingly crude and simple methods prevail, and have prevailed since the days of the Romans, in the mining of Sicilian sulphur. Steps hewn out of the rock lead to tortuous and disordered subterranean galleries attaining to depths of from 500 to 825 feet, but averaging about 600 feet. The crude ore is heated to the melting point of 115 deg. Cent., and collected as it is run off. There are two methods by which the sulphur is heated: one, by burning part of the mineral in what are locally termed *calcaroni*, or beehive ovens; the other by means of superheated steam forced into the deposits by hydraulic pressure, somewhat after the system in vogue at the American sulphur wells in Louisiana.



Mined lumps of sulphur at base of mounds, Caltanisetta, and calcaroni, primitive ovens in which the sulphur is heated.

One of the most drastic moves in the history of the Italian Parliament was made necessary by a crisis that arose in Sicily in 1906. It was the passage of an act by which the 180 sulphur producers of the island were forced to combine in a *consortium*, or state trust, and thereafter to deliver their product over to the Government, as mined. Among the members of this trust, which is known as the Consorzio Obbligatorio Zolfifero Siciliano, are princes, senators, and deputies of Sicily, and a one-time minister for foreign affairs of Italy.

The Sicilian industry, debilitated by



Mechanical operating plant of Jordan sulphur mine at Caltanisetta, with trackage and coke dump.

Molded cakes of refined sulphur cooling near smelter at Caltanisetta; atop of them two typical "carusi," or boy miners.

This is a huge bin forty-eight feet high and two hundred feet long into which liquid sulphur is being pumped.

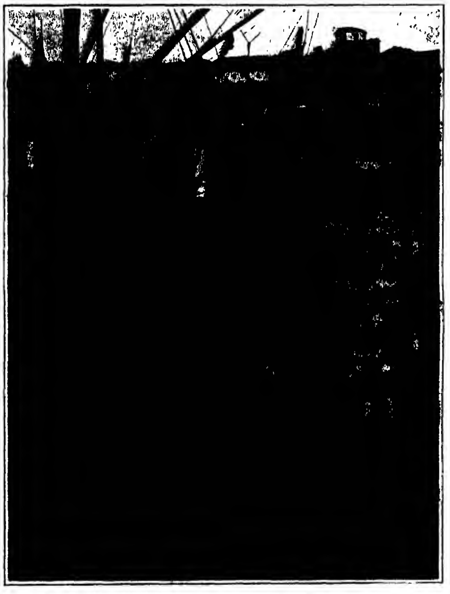
Loading a vessel with Louisiana sulphur at the rate of sixteen tons a minute. Contrast this with the method of loading Sicilian sulphur.

...of market speculation, usury and ...al *vendette*, late in the last century, staggered under the shock of news of the opening up of an immense deposit of sulphur on the gulf coastal plain of Louisiana.

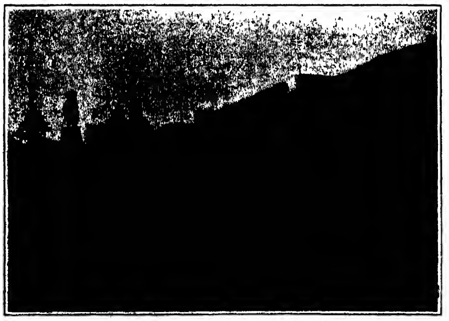
By Herman Frasch's invention of a process for liquefying sulphur in the ground, at a depth of 1,000 feet, and pumping it to the surface in fluid form, an immense alluvial deposit of sulphur in Calcasieu parish, Louisiana, on the Gulf of Mexico, was opened up in 1893. The deposit was in the form of a volcanic cone, the apex of which was 800 feet from the surface An eminent Italian engineer, Dr. Baldacci, delegated by his Government to investigate the report of the discovery, that had quickly reached Europe, not only confirmed it, but estimated the newly found store to aggregate 40,000,000 tons, or more than sufficient to meet the world's requirements for an entire generation. What most alarmed the Sicilians, however, was the fact, as reported by Dr. Baldacci, that the Louisiana sulphur was produced at an average cost of $3.68 per ton, as against $12 per ton, the cost of mining sulphur in Sicily Water, superheated to 350 deg Fahr, was sent into the ground in Louisiana, in columns wherein a pressure of one hundred pounds per square inch was maintained. When dissolution was effected, the liquid sulphur was pumped into great bins of about 150 by 250 feet, where it solidified to the consistency of sandstone, and awaited the attack of workmen to break it up, by blasting, for shipment.

The wells were sunk in groups, the individual wells being placed fifty to one hundred feet apart, and a single well would be found to have a daily production of four hundred to five hundred feet of sulphur and to keep up a steady flow for months at a time. The liquid sulphur as it flowed from the well was so pure that the company was able to guarantee a sulphur content of 99½ per cent, but the average purity well exceeded that figure.

Twenty 150 horse-power boilers were used for a single well, and this represented experimentation on a ponderous scale. The number of boilers employed to superheat the water used in the pumping has since been increased to 130, each of 150 to 300 horse-power, and arranged in eight batteries, containing with one exception 15 to 20 boilers each, and each battery of boilers capable of operating a well. Two of these batteries are placed in a group, so that one foreman can oversee both. The boilers are fired exclusively with fuel oil, pumped from wells located on the premises, and only three men, two firemen and one water tender, are required on each shift to the firing and the feed water in each battery. Similarly great economies have been effected in the dispatching of the sulphur for shipment. A flat car receives a load of thirty-five tons within fifteen minutes, while at the company's



Shipping sulphur at Catania, Sicily; antiquated methods of weighing and loading by hand labor, in baskets of straw, are shown.



Locomotive derrick in Louisiana taking up its charge of sulphur two tons at a time.

docks at Sabine Pass, Tex., about fifty miles away, one man is enabled to effect the automatic discharge of an entire train load in a few minutes, unassisted, and chartered steamships and, of late years, vessels of the company's own fleet have loaded more than ten tons per minute and sailed, laden with cargoes of 7,000 tons each, within twenty-four hours after arrival at Sabine Pass A striking contrast to the slow, laborious method of transferring the sulphur from the Sicilian stores at Porto Empidocle and Catania to waiting ships by hand, in baskets of but a few bushels each!

Confronted by this sudden development of a formidable competition in 1905, the Italian Government realized the seriousness of the situation It learned that the newly born sulphur interest, youngest of America's "infant industries," had not only intrenched itself in the markets of the United States and Canada, hitherto monopolized by the Sicilian product, but that it had begun an aggressive campaign in the European field It had even built at Marseilles a great refinery for the treatment of the Louisiana sulphur, brought to the French port in its own ships.

Premier Luzzati, who was then at the helm of Italy's Ship of State, resolved upon a step which showed how critical he regarded the situation that existed. He sought out the head of the American interest, Herman Frasch, the "wizard" of the Louisiana wells, who journeyed from Marseilles to Rome upon the invitation of the great statesman

In the course of a memorable conference between the two, the Italian Prime Minister dwelt upon the economic significance of the plight in which the Sicilians found themselves.

Frasch pledged his company to restrict their operations on the continent of Europe to such consumers as they had already contracted with, provided that the Sicilians would abandon the American field.

The organization of the Consortium, or state trust, followed, with the resulting shut-down of 120 of the 484 mines. The employees of these, the smaller of the island's mines, were disbanded But the attendant privation was minimized and the extreme results that the Government feared were obviated. Most of the laborers forced out of employment later swelled the tide of Sicilian emigration to the United States.

The production of Sicilian sulphur reached its high-water mark in 1905, with a total of 570,000 metric tons for that year, as against 390,000 tons in 1881 and 112,000 tons in 1860; but after the conclusion of the agreement between the Consortium and the Union Sulphur Company, the production diminished, and in 1909 totaled only 400,000 tons. At the beginning of the present century the produc-

(Concluded on page 150.)

Sugar Beet Industry of Germany

What Science Has Done for a Great Industry

By H. C. Price

Germany is the home of the sugar beet industry. It has about 400 sugar factories with a total average annual production of over 2,000,000 tons of sugar, about one half of which is exported. Sugar beet growing is the most profitable type of farming followed in Germany, and probably has done more than anything else to bring about the excellent type of intensive farming for which central Germany is so justly noted. The province of Saxony is in the heart of the sugar beet growing of Germany, and although it contains less than 10,000 square miles there are over 200 sugar factories in it. Good sugar beet land is worth $500 per acre, and the returns from sugar beet farming are large. This article is both a historical review and a summary of the technical methods that have elevated the sugar beet industry to its present eminence.—EDITOR.

THE beginning of the manufacture of sugar from beets is a direct result of the Napoleonic wars. In 1747 Marggraf, a German chemist, discovered that the common white field beet of Germany contained sugar, but this discovery was not considered as of any economic importance. But in the beginning of the nineteenth century, when Napoleon Bonaparte was in the zenith of his power, he put an embargo on the importation of sugar into Europe in order to strike a blow at England, since practically all of the sugar used in Europe came from the British colonies. This resulted in famine prices for sugar, and now for the first time Marggraf's discovery was thought to be of some economic value, and that possibly the beet might be utilized as a source of sugar. As a result, in 1812 a factory, the first of its kind in the world, was built near Breslau, Germany, for the manufacture of sugar from beets. In France likewise factories were soon built, and under the stimulus of war prices and government protection the new industry was established.

Since 1890 the average annual world's production of beet sugar has exceeded the annual production of cane sugar, and in 1910 the world's production of beet sugar exceeded 8,500,000 tons, or seventeen billion pounds.

The development in so short a time of the sugar beet as a source of human food is not equaled by any other plant anywhere in history.

Increase of the Sugar Content of the Beet

In 1812, when the first sugar was manufactured from beets, it took twenty tons of beets to produce one ton of sugar, and at the present time it only requires about six tons. This decrease in the amount of beets required to produce one ton of sugar has been due to two things: (1) more perfect methods of manufacture, and (2) to a higher percentage content of sugar in the beet, principally to the latter. This increase of sugar content has been the result of scientific plant breeding, and the results that have been attained in this line are the most remarkable and economically the most important that have ever been accomplished through the science of plant breeding. Beginning with a plant that did not contain over 5 per cent of sugar, systematic selection by the plant breeder has produced a strain that sometimes contains as high as 25 per cent of sugar, and the average for an entire crop season in Germany has been as high as 17 per cent, as was the case in 1910.

That this immense increase in the sugar content has been the development principally of the last few decades is shown by the following table giving the percentage of sugar found in beets that were produced under the most favorable European conditions:

Percentage of Sugar Contained in Beets by Decades

Year	Sugar	Year	Sugar
1838	8.8%	1878	11.7%
1848	9.8%	1888	11.7%
1858	10.1	1898	15.2%
1868	10.1	1908	18.1%

In America equally high percentages of sugar have been secured, in some cases even higher.

Production of Beet Seed.

The sugar beet is especially well adapted to breeding, since a test can be made of the sugar content of the individual without destroying it for the production of seed. The beet is a biennial plant, making its growth the first season and the following year producing seed. In selecting beets for sugar content they are harvested in the fall and in the laboratory a small section is bored out [illegible] beet and tested for its sugar [illegible]. This shows the sugar content of [illegible] dividual beet, and it is not injured [illegible] the production of seed the [illegible] spring. In this manner selections [illegible] made from generation to [illegible] pure strains and varieties [illegible]. Special beet breeding farms have [illegible] established in France and Germany [illegible] hundreds of thousands of individual [illegible] are tested each year. The [illegible] these farms is at Klein W[illegible] central Germany, where 12,000 [illegible] under cultivation and over fifty [illegible] beet breeding has been carried on [illegible] the most careful and scientific supervision.

The "plant" at Klein-Wanzleben, Germany, the largest beet breeding establishment in the world. The sugar factory, laboratories, seed warehouses and administration buildings.

Beet breeding laboratory at Klein-Wanzleben, Germany, for testing individual beets for sugar content.

Women harvesting beets. The type of laborers that are brought in from other provinces for the season.

Increase in Consumption of Sugar.

The world's consumption of sugar is now eight times as much as it was fifty years ago. From being regarded as a luxury, sugar has come to be a necessity in the every day diet of practically all civilized nations. It is the one product for which every individual seems to have a natural taste, and it is more generally liked by children than any other substance. The amount consumed varies greatly in the different countries, and as a rule is in proportion to the degree of civilization and average wealth of the nation. England and the United States have been far in the lead in the per capita consumption, as shown below, and are the heaviest importers.

Per Capita Consumption of Sugar in Pounds Per Annum.

England	89.5
United States	74.8
Switzerland	58.1
Denmark	56.7
Norway and Sweden	41.7
Holland	38.0
Austria-Hungary	37.2
Germany	36.9
France	36.0
Belgium	27.9
Russia	16.6
Spain	10.2
Turkey	8.2
Italy	7.7

There is no distinguishable difference between beet sugar and cane sugar as they appear on the market. They are entirely interchangeable, and the only determining factor in their use is the price at which they are sold. Although the production of cane sugar has increased rapidly, beet sugar production has advanced with a much greater rate of speed until now over one half the world's supply comes from beets. The increase in the world's production and the relative amount produced from sugar cane and from sugar beets during the last fifty years is shown in the following table:

World's Production of Cane and Beet Sugar in 1,000 Tons

Year	Cane	Beet.	Total	Proportion Beet Sugar
1860..	1,376	390	1,766	22.1
1870..	1,856	844	2,700	31.3
1880	2,084	1,531	3,615	42.4
1890	2,522	3,537	6,059	58.4
1900 .	2,978	5,440	8,418	64.6
1910.	6,236	8,471	14,707	57.6

The Labor Problem in Sugar Beet Culture.

The greatest drawback to the growing of sugar beets in America has been the labor problem. A large amount of hand labor is required, and in America this labor has not been available. In Germany it is done largely by women. According to the census of 1906 there were 5,500,000 farm hands in Germany, exclusive of the owners of the farms, and their families, and of this number 2,500,000 were women.

(Concluded on page 191.)

Correspondence

[...tors are not responsible for statements ... correspondence column. Anonymous com... cannot be considered, but the names of ...s will be withheld when so desired.]

...gmatypy and Spitzertypy

... of the SCIENTIFIC AMERICAN:

... with the article on "Stagmatypy," in ... AMERICAN for July 13th, the process ... for which a German patent was issued ... in 1905 should be of interest.

...py the coating of the plate consists of ...20 to 30 per cent albumin or gelatin in ...o 6 per cent of dichromate. The coated ...rain. After printing, the plate is etched ... ferric chloride (sp. gr. 30 to 40 deg. Bé.). ...typy, granulation develops during the ...

...of Spitzer's process are remarkable for the ...th which details are rendered. A number ...y the process are shown in *Photographische* ... for 1905, page 473.

...erman patent is No. 161,911, patented ...0th, 1901; issued July 7th, 1905.

..., D. C. BENJAMIN B. SCHNEIDER.

...anger of Bow-on Collision

...r of the SCIENTIFIC AMERICAN:

...nt editorial on the "Titanic" reminds me ...o you what I wrote to the chairman of the ... Investigating Committee, but have not seen ... any newspaper.

... a large ship, like "Titanic," moving swiftly, ... a large iceberg, the principal danger and the ...pal damage would *not* be in the crumpling of the ...or the flooding of several compartments, but in the ...vior of the boilers and secondary to that the be...or of the engines.

When the forward motion of the ship is suddenly ...pped nothing whatever could hold boilers and engines ... breaking loose and going forward and smashing the ...lkheads and probably the bottoms.

But in addition to this the boilers must break the steam ... and must immediately explode, and this would ...roy the ship.

This is submitted to your consideration, although it may be old. W. S. PROSSER.

San Jose, Cal.

[In his testimony at the Board of Trade Inquiry, London, the designer of the "Titanic" stated that if the ship had struck bows on, she would have crumpled up about 100 feet of her bow and would have taken several seconds to come to a state of rest. He stated further that the blow would have been so greatly cushioned that the machinery would not have been displaced.—EDITOR.]

A Word to the Socially Unfit

To the Editor of the SCIENTIFIC AMERICAN:

Kindly allow me to say a few words suggested by your editorial entitled "Lunacy and Morals," in your issue of July 13th.

From the deterministic, the only thoroughly scientific standpoint, there is no "line separating responsible wickedness from acts against the public peace which have their origin in perversities of the psychic apparatus." Both result from peculiarites of structure, physical or psychical, which are often as much beyond the reach of medicine or surgery as they are beyond the reach of the subject himself.

Now that the old conception of punishment as social revenge has died out, in theory at least, the question is no longer whether one who is a public menace is "insane" or "immoral." The point is that he is a diseased element in the social organism, and as such should be removed. Scientifically speaking, a man is no more to be blamed for crime than for insanity. With the odds overwhelmingly against the man who oversteps the bounds of social conduct, as they are, he who does overstep those bounds reveals a weakness either of judgment or of self-control, both of which are allied to other forms of mental weakness. This, aside from the fact that the "perversion of the moral sense" is either congenital or the result of early influences.

The fault of the newer humanitarianism is not that it "now holds extreme views as to irresponsibility for criminal acts," but that it does not recognise that to declare a man to be insane does not make him less a social menace nor does it alter the fact that he has become what he is by the action of laws beyond his control. Neither does it alter the fact that the health of the social organism demands that he be removed therefrom, and removed effectually.

On this point the altruism which has done so much for our western civilization has degenerated into a harmful sentimentalism which places an excessive value upon the mere form of human life, regardless of the worth of that life to itself or to society. We take better care of our idiots, lunatics, and criminals than we do of our children. The last are left to chance until they become idiots, lunatics, or criminals, when they begin to receive the attention which comes too late. A rational and truly humanitarian policy would be to eliminate these elements by a painless death, which would end many miseries, protect society, and purify the social atmosphere. Vast energies would thus be left free to attack the problem of social regeneration at its root, the children. The social organism can never know its own possibilities until it has given every child an opportunity to grow up under the best possible conditions, physical, educational, and ethical, and it is time that public solicitude shifted more in this direction. PAUL R. BIRGE.

Washington, D. C.

A Manufacturer's Views of Patents

To the Editor of the SCIENTIFIC AMERICAN:

Noticing in the papers that when Mr. Samuel O. Edmunds of New York city appeared before the Committee on Patents, he advocated making the date of filing the application on an invention the test of priority of the invention.

This might further the interest of justice in some rare cases, but I believe on the whole it would be a grievous mistake. It would result in the taking out of patents on thousands of unperfected, and consequently useless inventions. The theory of our present law is that unless the invention on a machine is something that will actually do the work intended, the patent is invalid. The theory is that the specifications and drawings shall show enough, so that a man with ordinary mechanical skill in the line to which the patent pertains may be able to construct a useful and operative machine.

If the original inventor did not apply for a patent on his first crude conceptions when he began experimenting, he would have to do everything under lock and key, and would always be in danger of having his conceptions patented by someone who found out what he was working on, so as to bar him from using it after he got it perfected.

It always takes a year, and usually two years, for me to make a material change in one of my machines. The change I am now making I have worked on steadily for three years, assisted by a corps of expert mechanics, during which time I have built over twenty models in reducing it to a practical and useful state of perfection. Under the present law I can do the work in the open, and have no fear of anyone stealing my invention.

I have been through a number of interference proceedings, and while they are expensive and annoying, I do not see any better way for insuring justice to all.

Sometimes I have grave doubts as to whether it is really very common to buy inventions for the purpose of suppressing them. It is true that concerns who have a large amount of money invested in special machinery and plant for the manufacture of a particular article, would be loath to make a change in that article which would involve a further large investment in tools and special machinery and the scrapping of a large portion of their original investment in this line. Perhaps a more serious determent is the fact that a change always involves the necessity of re-educating the staff and working forces to the production of something entirely new, during which period an inferior product is turned out and perhaps the reputation of the firm seriously injured. Also oftentimes things which, after long and careful testing, and which, viewed from every standpoint, appear to be practical, when put on the market, for some reason prove to be inferior to the original device. This is something that can scarcely ever be determined with a certainty until after some months or years in the field.

The fact that nearly all manufacturers of specialties, particularly those protected by patents, maintain expensive experimental departments, would tend to negative the theory that as a rule they desire to suppress new inventions. All such manufacturers receive weekly offers to sell patents on articles in their line or proposed improvements on their devices. Few, if any, offers are based on anything of any value whatever, and most of them have for their basis some impractical idea which has been offered by hundreds of others. There is one alleged improvement in the comptometer which has been offered to us on an average of once a week. This idea was tried out and discarded over twenty years ago and has since appeared in hundreds of adding and calculating machine patents. I have tried it out exhaustively on three separate occasions. Another was patented over twenty years ago. I manufactured it for a time, and found it to be of more damage than benefit. Yet continually I receive letters from men who think they have invented one or the other of these things, and that I am depriving the world of a great boon in refusing to turn over to them a factory and organization that has taken twenty-five years to build up, for the purpose of perfecting and putting their inventions on the market.

It would be utterly futile to try to explain to them why their ideas are impractical, and if one attempted to do so he would have time for nothing else, besides he would not succeed in convincing them. There was never yet suggested to me anything that I had not already considered and usually tried out exhaustively. I never bought any patent. Many a man has left my office with the statement that he was going after my scalp or that I would some day overlook a great opportunity by pursuing the course I do, only to some years after ask me to buy the machinery which he had purchased for the purpose of perfecting the manufacture of his supposed invention. If I had originally purchased his patent, he would always have believed that the purchase was only to suppress it. That class of inventor usually has little to do, so has time to make a good deal of noise, and a great many receive their statements at face value, hence the popular idea about buying up a patent to suppress it. Some manufacturers make a practice of buying up patents, but I do not believe that often they ever buy up anything of real merit for the purpose of suppressing it.

The cost of selling a patented article usually exceeds by far the cost of manufacturing. The public in its turn is very conservative, and as a rule all very meritorious inventions have to be forced onto the public—their introduction involves a tremendous amount of education. I believe that it is in this respect that patents have been beneficial to the public—much more so than from the tendency of our patent laws to encourage invention. If Congress should pass a law giving some firm the exclusive right to publish books treating of the method and use of the metric system and the exclusive right to make instruments for measuring and weighing by the metric system, in twenty years we would all be enjoying its benefits. As it is, no one can afford to introduce it, and Congress does not see fit to make its use compulsory.

It has been said that the greatest boon conferred on Christendom was conferred by Gerbert when, after disguising himself as a Mohammedan, he succeeded in obtaining admission to the Moorish universities, and after passing through two of them, returned into Christian Europe, bringing with him Arabic numerals. No one had a patent on their use, and for several hundred years they were not universally adopted, and school children could not be taught multiplication and division except in the small factors, which could be computed by mental perception with the use of pencil and paper. During that time, for business and engineering computations, everything was computed by the use of the abacus, such as is used by the Chinese and Russians to-day.

No one can question the value to mankind of the potato. Numerous explorers brought back to France, England, and Spain samples of the potato shortly after the discovery of America, but it was several hundred years before it became a common article of food, in spite of numerous recommendations by various great authorities that it be generally cultivated.

I do not believe a patent should be issued for any long period of time. I believe that seventeen years is about right. For some things the period is too short to enable those exploiting it to overcome the inertia of the public and reap any material benefits from the long years of labor, but no law can be so formed as to fit every possible case. What appear to be the most revolutionary inventions should be partly accredited to the inventor who first makes them practical and partly to the general advance in the mechanical arts. Seldom if ever has a revolutionary invention been brought out that has not been conceived and an attempt made to put it in material form hundreds of times before, only to fail either because the inventor has not the ability to perfect it or else mechanical arts are not advanced to a point where it could be successfully and economically manufactured.

Were it not for wars requiring the simultaneous manufacturing of large quantities of weapons, the sewing machine and the typewriter could never have been manufactured at a cost which would have made their purchase and use advisable. The machinery which has been evolved after many years for the manufacture of weapons had to be developed to a high point of efficiency before sewing machines and typewriters could be manufactured in large quantities and at a low cost. I can cite numerous other illustrations of this fact.

It is a serious question whether or not the one who pioneers a new art or invention does the public such a great injustice, even when he buys other inventions in the same line. The expense of pioneering is so great, that unless he has reasonable assurance of a monopoly which will warrant him in incurring the enormous expense of pioneering, he cannot afford to take the risk. I believe that a careful analysis will demonstrate that in those lines where a patent monopoly is the most complete, the public has received the most benefits and enjoys the most advantages in the way of improvement in quality of manufactured product.

Chicago, Ill. D. E. FELT.

Like most new things "natural gas gasoline" is the product of an imagination. For years it had been noticed that gasoline collected in the pipes into which the waste gases of oil wells had been turned. This "drip" was bought up by refineries. An imaginative inventor, John Lathrop Gray, made up his mind that he would find out why the "drip" accumulated at all. He found that gasoline could be squeezed out of natural gas, and took out the only patent which comprehensively covers the process now most widely used. This article, written by one intimately connected with the industry, explains the scientific principles of recovering gasoline from oil well gases.—EDITOR.

THE refining of petroleum oils as an art has been subject to a peculiar diversity of limitations. The infinite variety in physical characteristics of the crude oils which have been unearthed have imposed those limitations.

Crude oil may mean anything from an approach to asphaltum in character to the other extreme. An example representing the one extreme would be a dark brown or almost black substance having a pungent odor, the consistency of a thick molasses and a specific gravity of slightly more than 1000 as compared to water. A sample representing the other extreme would have a slight discoloration, only, from a pure white, and would be comparable in general appearance to the very lightest of sewing machine oils. So much for the liquid petroleum products which Nature has deposited for us.

In the majority of instances where petroleum is found, it is accompanied by more or less extensive deposits of natural gas. There are some exceptions in which petroleum is found alone. There are a great many cases in which gas is found not accompanied by petroleum, and many instances in which it cannot be shown that there is any physical connection between deposits of gas and oil.

It is an interesting but not greatly surprising fact that gases which are found residing with petroleum oils in the earth vary in physical characteristics almost as widely as do the oils which form the great family of liquid petroleum deposits, this with reference to specific gravity and variance of the relative percentages of the different hydrocarbon compounds of which the gas is composed.

Until about two years ago natural gases were estimated commercially as methane. It is a fact that the great volume of gas being produced and transported to large consuming centers may be so classed without great deviation from strict truth. Probably as much as 90 per cent by volume of the gas composition is methane, the remainder being ethane with very slight percentages in some cases of propane.

In dealing, however, with the gases which are found directly accompanying the petroleum oils as they reside in the strata from which they are obtained, we have a very different condition and a widely different general composition of gas. It is thought, now, that the variance in gas composition in adjacent oil wells is much greater than is that of the oils. Wells located within a narrow radius and producing, so far as can be observed, oils of uniform character from the different wells will produce gases which vary very markedly in percentages of the different hydrocarbons of which they are composed.

Within the last two years, a development has been carried to the proportions of an industry allied to refining, but which becomes necessarily a part of oil field operations, and it consists in the recovery of a refined gasoline which is extracted from oil well gases at the wells. There are a few exceptions to the statement that this product can be recovered from oil well gases only, but the writer believes that without exception it can be demonstrated that any gases which yield gasoline condensates to any considerable extent, communicate to and through oil producing strata. Since this phase of the petroleum industry has reached commercial proportions amounting to the recovery of probably some 2,000 barrels daily of a product which heretofore had gone to waste, it would be interesting to look into the physical conditions which make it possible. It will be most convenient to deal with the series of hydrocarbons known as saturated paraffins. It is possible that there may also be some exceptions to this latter classification.

If we consider, however, that a triangle may graphically represent the great family of saturated petroleum hydrocarbons, we can divide such a figure into percentages which may represent to the mind's eye, very clearly, the summary of facts involved.

We shall not permit the figure, or the percentages into which we divide it, to represent wholly relative volumes, but rather to represent combined volume and composition with reference to the structures forming the great group or family of petroleum hydrocarbons.

The dark base on which the triangle rests may represent the coke residue drawn from a petroleum still after the crude has been distilled into its various fractions; the second small percentage section of the triangle will represent petroleum tar and paraffin waxes; the third section, varying greatly in volume, may represent greases and lubricants; the fourth division may be made to represent lighting oils; the fifth, to represent naphthas; the sixth, to represent gasoline fractions; the seventh, to represent refinery products known as pentane, rhigolene, and cymogene. The eighth, to represent the heavy portions of condensible natural gases with which this article attempts to deal. The ninth division may be made to represent that portion of heavy gases which is intermediate between the product commercially accepted as gasoline and the great volume of gas product known as dry gas. The tenth and last division will be made to represent the methane portion, together with any impurities, of petroleum deposits, where gas and oil may be found in large volume. Such impurities as may be worthy of mention are carbon dioxide, free nitrogen, and some hydrogen sulphides.

To get a familiar conception of the chemical proportion of the compounds forming the triangular graphic representation, we may go to its base and look for a composition which is almost wholly carbon. The next division of the triangle will represent a product having a greater percentage of hydrogen and a lesser percentage of carbon in its make up, and when we have arrived at the third, or grease and lubricant division, we begin to find chemical compositions like $C_{24} H_{50}$ of the saturated series having the general form $C_n H_{2n} + 2$. The sixth group will bring us to a chemical composition with which we are quite familiar, viz., $C_7 H_{16}$, gasoline, naphtha, benzine. The seventh group will still further lower the relative carbon proportion, and we will have a range of compounds running from $C_6 H_{14}$ to $C_5 H_{12}$. The eighth division will represent our natural gas gasolines which are so closely related to the seventh group that it is not proper to designate them as different except as exceptions to this phase of the petroleum industry which we are considering now. The ninth group or division is to play an important future part in our domestic life. It represents that very considerable fraction of the greater number of oil well gases which can be liquefied by reasonable treatment and delivered in strong steel containers to isolated consumers for fuel and lighting purposes. The tenth and final division is $C H_4$ with the above-mentioned impurities, which exist to varying degrees in different localities, and are absent in the great majority of the important producing regions.

In getting a proper conception of this interesting matter, it must be borne in mind that the groups or divisions of petroleum products, unless subjected to extremely tedious treatment, are not sharply defined in chemical composition. This fact may be graphically represented again by the hypotenuse side of the triangle, which might represent the gradation from a hydrocarbon structure through all the minute steps from an all-carbon to an all-hydrogen composition, the hydrogen point being represented by the vortex of the triangle.

It is now easy to refer to and explain the method by which the product which is known as "natural gas gasoline' is recovered. For many years past in the operation of oil wells, where the gases escaping from them have been turned into a system of pipe lines for service, and the running of gas engines used to pump the wells, difficulty has been experienced under favorable winter weather conditions in those lines becoming filled with a liquid. Some water is frequently present, but more frequently the liquid found in the pipe lines

[illegible] to be gasoline. Many oil operations collect [illegible]ble quantities during the winter season of this [illegible]duct, which has been bought up by the refi[illegible] an inferior grade of gasoline. It obtained [illegible]on of inferiority from the fact that, in many [illegible]g lain in rusty pipes and come in contact [illegible]d dirty paraffin sediments, it has been dis[illegible] required filtering or redistillation. The [illegible] has, therefore, been content to receive [illegible]e one fourth to one third the [illegible]arket price for gasoline for [illegible]roduct, even though it be [illegible]and of apparently high grade [illegible]to refinery gasoline.

[illegible]l laws involved in the proc[illegible]ering gasoline from natural [illegible]posedly very simple. They [illegible]r to be the same as for the [illegible] of any liquid vapor sus[illegible] gaseous medium. The fact, [illegible]velops that the suspended [illegible]nt in natural gas being of [illegible] different chemical groupings [illegible]he matter somewhat and [illegible]he requirement of more ex[illegible]ment than the first glance [illegible]ve as necessary. Compress[illegible]ling of the gases containing [illegible]h suspension is all that is nec[illegible]ded the same be carried to a [illegible]tent and effected under prop[illegible]ent for the separating of the [illegible]e precipitated.

[illegible]ck to about the year 1906, we [illegible] investigators going further into [illegible]r than the application of vacuum [illegible] wells, and the recovery of the "drip" from lines connecting the pumps used to produce vacuum on the wells. They were employing air compressors to compress the gas to an extent much beyond that for which oil well vacuum pumps are designed to do duty. John Lathrop Gray obtained, apparently, the only patent which comprehensively covers the process, and the licensees under that patent seem to have found the most effective and extensive development of the industry.

The essentials of this Gray patent are the compressing and cooling of the gases, the separation of liquid products and the accomplishment of the same by the simplest and most effective means.

Gray used a simple type of separator for collecting the condensates, and an automatic trap which continually transferred the condensate to a place of storage.

The advantageous features of the method are greater than are seen at the first glance. One great difficulty in the development of the art has been to reduce the condensates to such a state of stability as will eliminate serious evaporation losses between points of production and consumption. It is now known that gasoline, either from petroleum oil or gas, will absorb considerable quantities of gas or even air, and that the absorption is a function of time, temperature and pressure.

Gray's method, therefore, of using traps to remove the condensates promptly, when precipitated, and minimizing the time of their exposure to gas under pressure, is of the utmost importance.

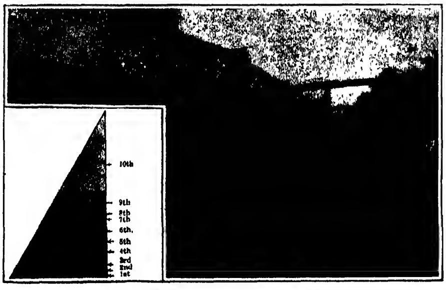
Just as in the case of crude petroleum oils, the new product, when produced by Gray's process, is capable of refinement to more homogeneous fractions. When to be handled as gasoline, the new product is very much improved by the removal of that portion embodied in a fraction which is too light and volatile to be stable at atmospheric pressure and the temperature conditions which must be met in use.

The recognition of new uses and increasing demand for the conservation of all fuel energy has held the promoters of the new industry to a realization of the necessity in providing means to effect the recovery and the separation into commercial fractions of the total product available. The possibility of fractionation by stage compression was early recognized by the writer, and many installations of machinery capable of ready adaptation to this method have been accomplished by the firm of manufacturers which has given the industry its greatest uplift.

The possibility of separation by stage compression treatment of a relatively large fraction of the product suitable for any fuel purpose, but which must be handled under restraint, brings about an entirely new phase of the petroleum industry which has not yet had scarcely more than an introduction to scientific and technical notice.

The successful introduction of the new product, which has been accepted as gasoline, depended largely on market conditions. It is comparable in inflammable characteristics to the highest grade refinery gasolines, and since its bulk has reached considerable proportions, the transportation of the same has received the attention of the Bureau of Explosives, and finally the Interstate Commerce Commission with certain restrictive safeguards which have placed its utilization at a premium, and the industry has been able to thrive only under the conditions of the consumers' demand which prevailed in 1910, and which now prevail. The whole year 1911 was one of plenty and predominant low prices of all petroleum products. The refiners were able to offer their product in serious competition with the new natural gas condensates to the extent of largely shutting its recognition out from the consumer.

The squeezers—direct driven straight line gas compressors, using for fuel residue gas after gasoline has been extracted.



Receiving tanks, in which the gases from oil wells are collected.

The insert shows triangle representing the great petroleum family. Taking out the 8th group which represents the heavy portions condensible to gasoline, the remaining residues are 1st —Petroleum Coke 2nd —Petroleum Tar and Wax. 3rd —Greases and Lubricants 4th —Lighting Oils 5th —Naphtha. 6th —Gasoline. 7th.—Refining products, Pentane, Rhigolene, Cyomogene 9th —Intermediate heavy gases. 10th.—Methane

Air and water cooled coils used in the condensing system.

The new product finds its best adaptation in the treatment of the refinery low grade gasoline fractions to make them suitable for motor fuels. Apparently, the new product will be sufficiently plentiful to bring the entire petroleum naphtha fraction, which is too low in gravity for successful motor fuel into a state of volatility making it entirely satisfactory, so far as carburetion and proper fuel mixture is concerned, and when so enlivened, this particular naphtha fraction has the greatest fuel value, having a greater weight for equal carbureting characteristics than any other known fuel.

The new product in appearance and physical characteristics is so nearly identical with the refinery first fractions, when properly produced and treated, that it requires careful judgment to distinguish it. The gravities of the natural gas condensates range from 76 degrees to 100 degrees Baumé (sp. gr. 0.68 to 0.61). It mixes permanently and without stratification with any refinery product which is not technically termed an oil. It also will mix sufficiently well with kerosene or lighting oil fractions to make a good satisfactory motor fuel, though, of course, such a mixture is not suitable for the cleaning of delicate fabrics where the presence of an oil would be objectionable. The term blending has been erroneously but conveniently adopted. The term itself would indicate the bringing together of two non-miscible materials. The light condensate is perfectly miscible with any "dry" or naphtha fraction and cannot be separated or re-obtained except by fractional distillation, and then only imperfectly.

The necessity for maintaining a cheap source of motor fuel will soon bring about the practice of "blending" the new "natural gasoline" or gas condensate with a 46 to 54 gravity lighting oil. Such a product will not be recognized or given proper credit, however, until the price of motor fuels makes it necessary to resort to such a means.

The very remarkable increase in motor fuel consumption which goes on is destined, however, to bring about revolution and the adoption of any new thing which can safeguard the consumer against prohibitive fuel cost.

For the question stands unanswered today, just as it has for forty years, have we reached our maximum crude oil production?

The advance in prices of the fuel fractions for this season alone is sufficient to warn us for the coming consequences when we do reach the zenith. We may as well assume that we are going to reach it one of these days, and take a few forethoughts as to what actually can be done to conserve the petroleum resources. We do not at all fully appreciate the importance of our petroleum, nor are any of us prepared to say what could be found to substitute it, were it no longer available.

If we go back to the graphical triangular representation of petroleum, which, being hurriedly drawn, makes no claim to precision, but can be counted upon to represent facts as roughly and about as closely as a quick conception could state them, we will see how great is the division in favor of fuels. For, beginning with the fourth group, everything upward is consumed either to heat us, move us, or light us.

If we look at the combined sixth, seventh, and eighth groups, and consider them as adapted to gasoline motors, then consider the number and extent of these motors; and if we look at the tenth division, representing natural gas, and consider that Buffalo, Erie, Cleveland, Cincinnati, Pittsburgh, practically all the intervening area and much surrounding, represents possibly one half the natural gas consumption; that all these communities depending on natural gas have reasonable expectation of many years of service, we get a good comparative idea of space nine, which represents what is being wasted, what has always been wasted throughout the life of the crude oil industry

The Flight of Projectiles—II

The Actual Positions of a Shell from Gun to Target

By Rear-Admiral N. C. Twining, U. S. N., Chief of the Bureau of Ordnance

Reproduction of Motions.

IN 1911 the Bureau of Ordnance of the Navy Department made a small model projectile and suspended it on gimbals. The projectile was then rotated at a speed of 3,000 to 5,000 revolutions per minute (being about the speed of rotation of a large-caliber projectile). To simulate the air resistance in flight, a blast of air was directed against the rotating projectile, and the behavior of this projectile confirmed the theory in all respects. As soon as the blast of air was directed against the rotating projectile, the projectile began to precess about the direction of the air. As the blast of air was changed in direction to simulate the changing direction of the resistance in flight, the projectile's axis depressed to meet the new direction of the air blast.

A similar demonstration can be made with an ordinary gyroscope. With care in manipulation the partial precessions made by a projectile can be simulated.

Penetration of Armor.

It is evident, even to the lay mind, that if projectiles struck with their axes not in the trajectory, penetration of armor would be almost impossible. This will be evident from an inspection of sketch No. 6.

The forward part of the projectile would strike first, but as the point of the projectile is not moving in the direction of the trajectory, there would be a tremendously powerful moment forcing the projectile broadside against the armor. Practically no harm would be done to the armor, and the projectile, being forced at high velocity broadside against the armor, would be broken up.

The fact that armor has not more often been pierced in naval battles is used by those who believe the shell does not strike point on as a proof that their theory is correct. They argue that if the projectile struck point on, the armor would be pierced.

The small number of armor penetrations in naval battles is due to a number of causes.

First. The armored part of a vessel is but a small part of the whole target, and, therefore, of the relatively small number of hits that have been made in naval engagements, only a few have been made against armor.

Second. Frequently high explosive shells, with thin walls and sensitive fuses, have been used in naval battles, and these projectiles on striking armor will break up or explode without penetrating, as such projectiles are not designed for penetrating armor.

Third. Even with well-designed armor-piercing projectiles complete penetration is not likely when the projectile but slightly overmatches the armor, unless the impact is not far from normal. Projectiles striking armor at an angle of more than about 10 degrees from normal are subjected to severe cross-breaking stresses, as will be seen from sketch No. 7.

It is not expected that penetration will be secured under such conditions without the breaking up of the projectile, unless the projectile considerably overmatches the armor.

It is due mainly to the foregoing causes that armor penetrations have not been more frequent in naval battles. To demonstrate, however, that penetration will occur at battle ranges, and to further demonstrate that the projectile does travel with its axis in the trajectory, the Bureau of Ordnance of the Navy Department, in 1911, conducted a series of firings against modern 8-inch and 10-inch armor. Three hits were made at a range of 7,800 yards, one in an 8-inch plate, and two in a 10-inch plate. All three projectiles penetrated the armor, leaving clean, round holes. The evidence was conclusive not only that the projectile traveled with its axis in the trajectory, but that modern armor could successfully be penetrated at battle ranges, and that the data obtained from short-range firings at the proving grounds could be applied equally well to long-range firing.

Retardation of Velocity.

There is another proof that projectiles in flight must travel nearly point on. It is evident that the retardation of the projectile, due to resistance of the air, must be much less when the projectile is moving point on than when it is moving considerably inclined to the trajectory, as in sketch No. 2. In the latter half of this trajectory (see first article) the area on which the air pressure acts has so greatly increased over that in the first part of the trajectory that the velocity of the projectile toward the end of the range would fall off very rapidly. It is found from actual firing, however, that the retardation of velocity in the latter part of the trajectory is actually somewhat less than the retardation in the first part. This means, of course, that the projectile must travel practically point on throughout its flight. The ranges obtained from actual firings do not vary more than one or two per cent from the ranges calculated by assuming that the projectiles travel, throughout their flight, point first.

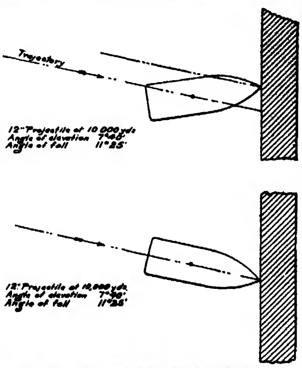
Explanation of Drift.

It is found that all projectiles having right-handed twist drift to the right. This is exactly opposite to the drift or curve of a baseball, which with a right-handed twist drifts to the left. The explanation of the left-handed drift of the baseball is simple. The air, rotating with the baseball, banks up on [illegible] against the still air to a greater degre[illegible] on the left side, and the resultant reac[illegible] against the baseball deviates the baseb[illegible] There is a similar effect occurring in pr[illegible] is very small, and the drift of projectiles [illegible] causes.

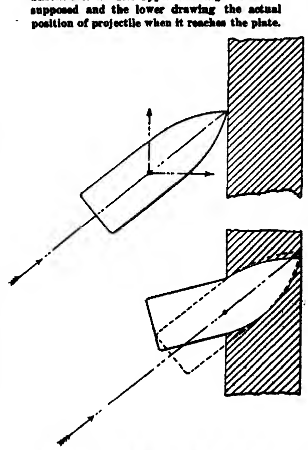
The rotating projectile is continually [illegible] tial precessions, the point of the projecti[illegible] tically always slightly to the right of the [illegible] of the trajectory. It is evident, therefo[illegible] is a small component of the air resistanc[illegible] lates the projectile to the right. This is [illegible] element in causing deviation in project[illegible] jectiles with right-handed twist drift to [illegible]

In addition, there is the effect of the fri[illegible] which assists in moving the projectile [illegible] right.

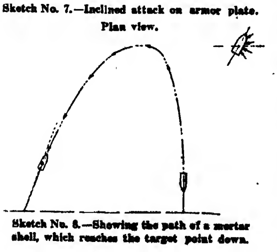
If the axis of the projectile remains p[illegible] original direction, as in sketch No. 2, it w[illegible] cult, if not impossible, to account for the [illegible] projectile. If it is maintained that the [illegible] mains parallel to its original direction, no[illegible] tional forces could give the projectile devi[illegible] these forces would decrease with the ran[illegible] quently, the rate of drift would fall off as [illegible] increased. Exactly the reverse takes place [illegible] projectiles, the drift increasing very rapidly w[illegible] crease of range. This increase of drift is occa[illegible] principally by the fact that the amplitude of the [illegible] cessions increases as the range increases; that is, [illegible] point of the projectile deviates farther from the [illegible] jectory. The resulting component of the air resista[illegible] which translates the projectile bodily to the right, [illegible] therefore stronger, and as the velocity of the proje[illegible] is being continually lessened, the drift increases rap[illegible]



Sketch No. 6.—The upper drawing shows the supposed and the lower drawing the actual position of projectile when it reaches the plate.



Sketch No. 7.—Inclined attack on armor plate. Plan view.



Sketch No. 8.—Showing the path of a mortar shell, which reaches the target point down.

High-angle Fire.

In high-angle fire it is very necessary, in order to ensure accuracy, that the projectile fall point first. As the angle of elevation increases the axis of the projectile must turn through larger and larger angles, in order to descend point first, and the greater part of this change of direction has to be made in traveling a relatively short distance near the top of the trajectory. This will be evident from an inspection of sketch No. 8.

Those who believe in sketch No. 2 would predict that all projectiles fired at high elevations would fall base first. Yet, all records and data show that these projectiles fall point first until angles of elevation of more than 70 degrees are reached. If fired at elevations exceeding 70 degrees, projectiles may fall base first, as will be clear by reference to sketch No. 8. It should be understood that the angles mentioned vary somewhat, and depend on the projectile used, its velocity, and its speed of rotation. In general, for high-angle fire a fairly low rotation is used (1,500 to 4,000 revolutions per minute), in order that the projectile may respond quickly and fall point first. As low velocities are used for high-angle fire, a low speed of rotation will ensure stability. It can readily be seen from sketch No. 8 that if a projectile has a high speed of rotation, and, consequently, a precession of slow rate, and small amplitude, there will be a definite angle of elevation for that projectile, such that when the projectile reaches the top of its trajectory the direction of the air resistance will change faster than the tendency of the point to follow. It should be borne in mind that owing to the low velocity of the projectile at the top of its trajectory, the gyroscopic moment is very small, even although the lever arm increases rapidly with the change of direction of the air resistance. The gyroscopic moment being relatively small, the projectile changes the direction of its axis very slowly. As the point of the projectile dips and tends to follow the rapidly-changing direction of the air resistance, it lags behind in this movement. There soon comes a time when the direction of the air resistance is broadside to the projectile and directly through the center of gravity. At this point the projectile has no tendency to precess, and travels broadside through the air, the precession practically vanishing. As the projectile approaches the descending branch of the trajectory the air resistance falls below the center of gravity. The direction of the air resistance is now upward, and the point of application of this resistance is in the lower part of the projectile. This tends to start a precession of the projectile with the base of the projectile precessing around the air resistance. That is, the base of the projectile tends to come over to meet the line of the air resistance, and thereafter the projectile falls base first. The angle of

elevation beyond which the projectile falls base first is reached sooner in proportion as the speed of rotation is increased, the projectile shortened, and the velocity decreased.

In May, 1912, five 12-inch projectiles were fired from United States Army mortars at an angle of elevation of 65 degrees. The observing party consisted of four officers and three enlisted men. All five projectiles were seen in the descending branch of the trajectory, falling point down. The results of this firing confirmed those previously obtained from similar firings.

Satisfactory firing has also been obtained at angles as great as 70 degrees, though it is found that the drift of the projectile is likely to be irregular at this elevation.

The angle of elevation which decides whether the projectile will fall point first, or base first, depends to such an extent on the variables previously mentioned that it is not possible to state more than that for the conditions under which mortars are fired the angle is probably not much greater than 70 degrees. Mortar fire is usually limited to angles of elevation of 65 degrees.

Authorities.

A large number of scientific authorities might be quoted, all of whom are believers in sketch No. 1. The eminent German authority, Prof. Cranz, and the eminent British authorities, Prof. Greenhill and Prof. Henderson, have demonstrated that the axis of a projectile remains sensibly tangent to its trajectory. Brig.-Gen. William Crozier, Chief of the Ordnance Department of the U. S. Army, also maintains the correctness of sketch No. 1. There is not an authority in any country who maintains the correctness of sketch No. 2.

It should be understood that the foregoing discussion of the flight of projectiles is complete only in so far as pertains to the object of this article. No mention has been made of the nutations described by the point of the projectile, or of the motions occasioned by forces impressed on the projectile on leaving the gun. There is much information that could be given on the action of the air resistance, the effects of various riflings, etc., but none of these have more than an indirect bearing on the subject, and do not change in any way the deductions in this article.

It is believed that the credence given to sketch No. 2 has been due wholly to popular misconception, and it is hoped that sufficient data have been presented in this article satisfactorily to establish the fact that a rotating projectile in flight must have its axis at all times sensibly tangent to the trajectory.

High Temperatures and the Electric Furnace

The Different Types of Electric Furnaces

By Prof. Joseph W. Richards, Lehigh University

WITHIN the last twenty years, electrically-generated heat has been a favorite topic of discussion among chemists and metallurgists, and the possibilities of using it industrially are attracting great attention. Various types of electric furnaces have been devised and put in operation, for such various purposes as producing pig iron, melting steel, melting brass and bronze, making silicon carbide, calcium carbide, titanium carbide, converting ordinary carbon into graphite, melting quartz, fusing glass, reducing tin ores, melting gold and silver precipitates, converting nitrogen and oxygen in the air into nitric acid. In fact, the uses of electric furnaces have become so various that a large-sized book can easily be written about it, and several such are already in print in the German, French and English languages. Any bookseller, or importer of French or German books, can furnish this literature to any one interested in it.

There are various types of electric furnaces, adapted to different kinds of service. For some purposes extremely high temperatures are necessary, and for these the electric furnace is indispensable, since the result desired cannot be obtained in any other kind of furnace. The highest temperatures attainable by combustion of solid or gaseous fuel, with pre-heated air, approximate 1,500 to 2,000 deg. Cent. (2,700 to 3,600 deg. Fahr.), and it takes a large consumption of fuel and there is a large waste of heat in attaining such temperatures on an industrial scale. The electric furnace, however, is limited in temperature only by the resistance of the material with which the furnace is lined, and the volatilizing temperature of the carbon electrodes used for carrying current into the furnace. The latter temperature approximates 3,700 deg. Cent. (6,700 deg. Fahr.), which is above the melting point of any ordinary material with which a furnace can be lined, excepting carbon. The ordinary refractory materials used in furnaces burning fuel melt at a temperature between 1,500 and 2,000 deg. Cent. (2,700 to 3,600 deg. Fahr.), and carbon is practically the only material which will stand the higher temperatures attainable in an electrical furnace.

It must not be supposed, however, that the electric furnace necessarily must be run only for the attainment of very high temperatures. Some of the most successful electric furnaces, operated where electric power is cheap and fuel is relatively dear, are operated at temperatures no higher than are obtained in ordinary non-electrical furnaces. The electric current is in this respect somewhat like a race-horse which is capable of running at high speed (high temperature) and yet which can be loaded down so as to work at low speed upon heavy loads (low temperatures). In fact, the ordinary electric oven or the toaster used in our houses is on the principle of an electric furnace, but operates at very moderate temperatures.

Arc Furnaces.

Such furnaces are simply enormous electric furnaces, on the same principle as an electric arc used for lighting, excepting that they are surrounded, as completely as possible by the material to be heated, and the heat radiated from the arc is utilized for purposes of fusion, chemical reaction, etc. The maximum temperature close to the arc may be as high as 3,700 deg. Cent. (6,700 deg. Fahr.), but the material surrounding the arc is not by any means necessarily heated to this extreme temperature. The charge receives the radiated heat and is carried to as high a temperature as the amount of heat radiated from the arc can heat the substance. If the substance is small in amount and brought nearly in contact with the arc, it may be heated nearly to the very high temperature named; but if the arc is surrounded by a large mass of the substance under treatment, then the material is heated only to the average temperature to which the electric energy converted into heat in the arc is capable of heating this large mass of material; this temperature may be almost anything, down to ordinary low furnace temperatures.

Illustrations of the use of the arc furnace are the Stassano furnace for melting steel, the DeLaval furnace for smelting zinc ores, the calcium carbide furnace, the ferro-silicon furnace, the furnace for fixing atmospheric nitrogen and thus producing nitric acid from the air. These furnaces work with the material heated from 1,500 deg. Cent. (2,700 deg. Fahr.) to 3,000 deg. Cent. (5,400 deg. Fahr.). Their chemical possibilities depend upon either one of two things, first, that materials for reactions are produced in them not producible in furnaces run by fuel (nitric acid, calcium carbide, ferro-silicon), or, second, that they are cheaper to apply than ordinary furnaces (smelting zinc ores and melting steel, in Sweden or Norway).

I have mentioned some of the more common applications of these enormous arc furnaces, but many others are under experiment and will undoubtedly be developed in the future. Their real and proper field is for carrying on operations at high temperatures not obtainable by other and non-electric means.

Resistance Furnaces.

This type of furnace passes the electric current continuously through some material offering resistance, and generates therein the high temperature required. There is no arc or break in the electric circuit; these furnaces are run simply on the hot-wire principle—a conductor is heated by the passage of an electric current, and sufficient current is sent through a particularly designed resistor to generate the heat and temperature necessary for running the furnace.

This is a large, useful and important class of furnaces, which is entering into many industrial operations. They are preferably operated by alternating current, although this must be of low voltage for most resistance furnaces. Examples are numerous; one of the simplest is the furnace of Mr. Acheson in which several tons of ordinary anthracite coal is converted into graphite by the passage of the electric current through the coal itself, thus heating it (properly shielded from the entrance of air) to a temperature of at least 3,000 deg. Cent. (5,400 deg. Fahr.) during a period of about twenty-four hours and converting it into soft unctuous graphite of many times the value of the material put in the furnace. Another example is the mixing of ordinary silica sand with coke and saw dust, and passing an electric current through a heap of the material piled between electrode terminals twenty to thirty feet apart. With a voltage of 100 to 200, and a current of over 1,000 horse-power, the electric current generates within the mass a temperature sufficient to form from these ingredients the well-known material "Carborundum," which is formed at a working temperature of 2,240 deg. Cent. (4,000 deg. Fahr.). Large industries have been founded upon the invention and use of these electric furnaces, so simple in principle and yet which require the highest inventive skill and industrial pertinacity to devise and operate successfully.

Induction Furnaces.

These are really a special kind of resistance furnace, the material or resistor being heated by the passage of an electric current, but not by the current originally sent to the furnace. The furnace itself is an electric transformer, receiving high-voltage alternating electric current, and transforming it to low-voltage current of great quantity, and the induced or secondary current of the transformer is the heating current which passes through the resistor and doing the useful furnace work.

A reference to the ordinary transformer with which almost every one is familiar may make the matter clearer. Electric current is sent along many of our thoroughfares at 2,000 volts tension, a current which would be very dangerous if it entered our houses, but which is transformed at convenient stations into low-tension current for safe use. The apparatus accomplishing this is called a transformer, the original current passing through the primary winding of the transformer, while the useful current is taken away from the secondary winding. The induction electric furnace operates on exactly the same principle; it has a primary winding receiving the high tension electric current but its secondary winding is the material itself which is to be heated, arranged in a closed circuit, so that all the energy of the secondary electric current is utilized as it is generated in the furnace itself.

Electric Furnaces.

These last are in reality not primarily furnaces; they are furnaces only *incidentally*. If we electrolytically decompose a liquid by passing a direct current through it, the operation is electrolysis. Such operations are familiar to every one: Gold, silver and nickel-plating baths; electrolytic refining of copper, silver, gold, lead; electrotyping; electro-engraving; reproducing coins, medals, etc. Others less well known are the obtaining of metallic sodium from fused caustic soda, of calcium from melted calcium chloride, of aluminium from a fused bath containing fluoride of aluminium and sodium with alumina (aluminium oxide) dissolved in it. Now, when these fused baths are kept melted by the heating effect of the passage of the electrolyzing current itself, the apparatus is called an electrolytic furnace. It is, therefore, a pot primarily run for electrolysis, whose necessary temperature may be maintained by externally-applied heat (as by building a fire around the pot); but when this necessary temperature is maintained by the internally-generated electric heat, the result is not simply an electrolytic cell, but an electrolytic furnace. The amount of heat generated by the current depends on the strength of current and the distance of the electrodes apart; it can be regulated with exactness to that required to supply radiation losses and keep the contents at the proper working temperature. Sir Humphry Davy was the first to experimentally use this principle, Mr. Charles M. Bradley of New York patented the electrolytic furnace, and Mr. Charles M. Hall was the first to practically run electrolytic furnaces in the production of aluminium.

These types of furnaces, with others possibly still to be invented, are revolutionizing many branches of industrial chemistry and metallurgy, and are founding or establishing many new ones. They deserve serious and intelligent attention.

The German Observatory in Spitzbergen, which was established by Prof. Hergesell partly with a view to determining the meteorological conditions that will be encountered by the projected expedition of Count Zeppelin *via* airship to the North Pole, has completed a full year's work with such fruitful results that it has been decided to keep the institution in operation another year. The two observers, Drs. Rempp and Wagner, have been relieved by Dr. Kurt Wegener, lately in charge of the Samoa Observatory, and Dr. Robitzsch. During last winter a series of aerological observations was carried out with kites, pilot balloons, captive balloons, and sounding balloons, yielding a unique body of information concerning the winter conditions in the upper air of the Arctic regions. Valuable contributions to the climatology of Spitzbergen were made through the maintenance of three meteorological stations at different altitudes; the highest on Mount Nordenskjöld (3,360 feet). Unbroken series of magnetic and seismological observations were also made.

Six Cylinder Models

Touring Car, 5-passenger, $2400 Torpedo, 4-passenger, $2400 Limousine, 7-passenger, $3700
Touring Car, 7-passenger, $2600 Roadster, 2-passenger, $2400 Coupé, 4-passenger, . . $2700
Prices include full equipment.

Touring Car, 5-passenger, $1950 Torpedo, 4-passenger, $1950 Limousine, 7-passenger, $3250
Touring Car, 7-passenger, $2150 Roadster, 2-passenger, $1950 Coupé, 4-passenger, . $2250
Prices include full equipment.

WE announce for 1913 big improvements in Chalmers cars in *comfort, convenience* and *appearance*. For it is along these lines that we believe the greatest advances in automobile building are to be made.

Few changes have been made in our chasses. The mechanical features of our cars have been right from the beginning. Satisfactory service in the hands of 27,000 owners proves this.

Here, then, are the principal additions and improvements on Chalmers 1913 cars:

Easier Riding Qualities

Luxurious comfort is built into every detail of Chalmers cars. The Turkish cushions, 11 inches thick, are soft as a down pillow. They are the highest grade automobile cushions made.

The upholstery is of the luxurious overstuffed type. All seats are wide, filled with high grade hair and covered with heavy, soft, pebble-grained leather. A Chalmers car gives you the same restful comfort as a big armchair.

The long wheel base minimizes road shocks. Big wheels and tires, and long elastic springs make all roads smooth. You can ride all day in a Chalmers without fatigue.

More Conveniences for Operator

Electric Lighting, the last touch of luxury, is regular equipment for 1913 on the "Thirty-Six" and the "Six." The Gray & Davis system which we use is featured on some of the highest priced cars; we believe it is the best lighting system built.

Just touch a switch on the dash and you can light at will head, tail, and side lights. No hunting for matches or gas tank key. No getting out of car in dust or mud.

And no more cranking. The Chalmers air pressure starter made 1912 a self-starter year. A season's use has proved this the simplest and most efficient starting device yet designed. You simply press a foot button on the dash and compressed air, released from a tank beneath the car, turns the motor over until it starts on its own power. No danger. No strain on motor.

Continental demountable rims reduce tire trouble to the minimum. Occasional punctures you *may* have are no longer a serious inconvenience. With demountable rims you can change tires in a few minutes.

On the new style Chalmers dash is carried every control and indicator—ignition switch, self-starter button, electric light switch, speedometer, gasoline pressure pump, carburetor adjustment, air gauge, oil sight feed, priming lever, horn bulb—all easy to see and easy to reach.

Added Beauty

Chalmers cars have always been known for their "looks." For 1913, they are even more beautiful than in the past. Flush-sided metal bodies have the graceful bell-shaped back. Dash is of one piece with body. Top of hood and sides of body form one line from radiator to rear seat.

Handsome nickel trimmings will be regular equipment. Leather lining throughout the body and on the dash leaves nothing to scratch or mar. Twenty-one coats of paint and varnish give a finish that cannot be surpassed.

We have perfected Chalmers cars along these lines, we believe, to a greater extent than any-one else, because for the last ten months we have directed all our efforts to making our cars even more *comfortable*, more *convenient* and more *beautiful* than ever before.

The Chalmers "Six," $2400 —A Maximum Car

Quantity production and increased manufacturing facilities make possible this unprecedented price of $2400. Here is a tried and proved six-cylinder car of the finest quality—of Chalmers quality—the first thoroughly high-grade six-cylinder car at a moderate price.

We are proud of this car. No automobile can give you more service, more enjoyment, more satisfaction and pride of ownership than the Chalmers "Six."

In addition to the big features of Comfort, Convenience and Beauty listed above, please note the following:

Power Enough For Anyone

The "Six" motor is a giant of power. Though rated at 54 h. p., it actually develops 60 to 70 h. p. The long stroke motor—4⅛" bore x 5¼" stroke—gives it a strong "pull" in sand or mud or on the steepest hill. It can be throttled down to a walking pace on high gear. It picks up instantly. An ideal motor for every requirement—mile-a-minute speed, slow running in city traffic, hill climbing, or dogged ploughing through sand or mud.

18 Notable Features of Chalmers Cars for 1913

Electric Lights	Increased Wheelbase	Jewelled Magnetic Speedometer
Turkish Cushions	Improved Springs	4-Forward Speed Transmission
Eleven-inch Upholstery	Chalmers Self-starter	Big Wheels and Tires
Nickel Trimmings	Long Stroke Motor	Dual Ignition System
New Flush-sided Bodies	Demountable Rims	Carburetor Dash Adjustment
Special Silk Mohair Top	Cellular Radiator	Rain Vision Windshield

The Utmost Flexibility

Chalmers four-forward speed transmission provides a gear for every requirement. It enables you always to select the gear that will carry your car through any kind of going in the quickest time and with the least strain.

Big wheels and tires.—36" x 4½"—insure easy riding and cut down tire trouble and expense.

Control levers inside the body; pedals for clutch and brake conveniently located; improved accelerator which does not tire the foot; gasoline shut-off valve inside the tonneau; exceptional oiling facilities; controls on dash within easy reach—make the "Six" a delightful car to drive.

You Feel Safe in Your Chalmers

The most careful attention has been given by Chalmers engineers to the *factors of safety*. Wheels are unusually sturdy. Axles are built in our own factory, of the highest grade steels. Double drop frames are heavy and of finest heat treated steel. Brakes are extra large in proportion to the weight. Steering gear is of new Chalmers design, with extra heavy drop forged connections—none stronger or easier to operate.

Even to the smallest details, the "Six" is a maximum car. Door locks are concealed and equally accessible from inside and outside. Bodies are thoroughly ventilated. All parts of the car are unusually accessible.

The "Thirty-Six," $1950— With Fine New Features

Striking improvements and added features make the 1913 "Thirty-Six" more than ever an ideal all-around motor car. It has power in abundance, speed, hill-climbing ability and rugged endurance to meet the utmost demands.

First offered to buyers last year, this car has proved the most popular ever sold at the price. Many refinements and improvements for 1913 give even greater smoothness, quietness, comfort and convenience. For style and good looks it is not surpassed.

The wheel base of the 1913 "Thirty-Six" has been increased to 118 inches, which still further improves its easy riding qualities.

Luxurious Turkish cushions, 11-inch upholstery (the same quality as used on some $5000 cars), tilted seats, all give the greatest possible riding ease. Seats are exceptionally roomy.

Big 36" x 4" tires carry the car smoothly over the roughest roads. The "Thirty-Six" is over-tired, which means less tire expense. Springs are unusually flexible.

Electric Lights on These Cars

Full electric lighting by the Gray & Davis system is furnished on the "Thirty-Six."

Chalmers self-starter, simplified and improved, is furnished on the "Thirty-Six" of course.

A reliable Speedometer, a jewelled, magnetic instrument, is regular equipment.

1913 bodies are greatly improved in design and finish. They have the integral cowled dash, on which are carried all controls. Everything for the handling of the car is within easy reach.

Note the wide doors, smooth straight sides, rounded back, graceful cowled dash, elegant appointments.

The "Thirty-Six" has even more graceful lines than last year. The painting is of the highest quality.

Mechanically Correct

This car will do your work with *power to spare*. The splendid long stroke motor—4¼" x 5½"—has wonderful pulling qualities. Quiet and smooth running at all speeds.

The four-forward speed transmission is one of the distinctive Chalmers features largely responsible for the success of the "Thirty-Six" last year.

Other Chalmers features which made this car such a marked success are retained—such as dual ignition, demountable rims (five), genuine honeycomb radiator, dash adjustment for carburetor, large brakes, frame and steering connections of extra weight and strength.

The 1913 Chalmers "Thirty-Six" offers you every motor luxury—at a medium price.

Chalmers Motor Company, Detroit

The New Chalmers "30"— Self-Starting, $1600

With improved motor, Chalmers self-starter, 34"x4" tires, demountable rims, larger brakes, beautiful, new flush-sided body, the 1913 "30" at $1600 is a greater value than ever before.

The price includes also gas lamps and oil lamps, Prest-O-Lite tank, dual ignition, full tool equipment.

For the man who wants a light, fast, low priced, but classy car, the 1913 "30" is the best buy ever offered.

The Chalmers "30" has for five seasons set the standard of values among medium priced cars of this power. It has won more endurance contests, broken more records, been victor in more races than any other car of its size and power. And it has a wonderful record of steady service and satisfaction in the hands of owners everywhere.

Two body types are offered: 5-passenger touring car, $1600; 4-passenger torpedo, $1600.

Fixed Chalmers Policy— Quality Cars at Medium Prices

For 1913 we are adhering to our established policy of always giving the greatest possible value for the price. We have incorporated in our new model, at medium prices, all of the features of higher priced cars and many features not found on other cars of any price.

Chalmers cars have always been known as quality cars. We have never built a "cheap" car, but always high quality cars at medium prices. Big production has enabled us to build such cars at lower cost than could anyone without our volume. We have never tried to secure big volume, however, at the expense of quality or advanced features. Yet each year the extraordinary values in our cars have brought a steady natural increase.

1912 Our Record Year

This past year, 1912, was the best year we ever had. It set a new Chalmers record. Our business showed an increase of 43% over the season of 1911.

We believe that our business will further increase as people appreciate quality at medium price instead of *quality* at *high* prices or mere *quantity* at *low* prices.

We believe the more automobiles come into use, the greater will be the conviction that it doesn't pay to try to save $300 to $500 on the original price, and buy something merely because it is offered at a low price.

Medium priced cars of quality—not only ours, but other good medium priced cars—offer the best values for the money in the long run, and you don't have to run them very long to find it out.

Built in Our Own Shops

Chalmers cars are built by Chalmers workmen in Chalmers shops under Chalmers inspection. We build our motors, transmissions, axles, self-starter, steering gear, and other important parts. We cut our own gears, heat-treat our steels. We even have our own foundry.

No automobile manufacturer builds in his own plant more of the parts of his car than we do. No motor car factory is more completely equipped with new machinery.

Experts tell us no car is built with greater care or more skillful workmanship than the Chalmers; none is subjected to more careful and painstaking inspection.

Backed by Sound Guarantee

Chalmers cars are built and guaranteed by a company of the soundest financial standing. We have a plant covering 30 acres of ground and have $6,000,000 invested in our business. We have made this great investment because we expect to be in this business permanently, and we are convinced that permanent business can only be built up where a manufacturer makes his own parts.

Making our own parts means greater accuracy in our cars and greater value for you. The saving we make by eliminating parts-makers' profits, goes into added quality.

We have prepared a book about the Chalmers factory. It tells, in an unusually interesting way, how Chalmers cars are made. Write for it on the coupon attached.

Order Now For Early Delivery

Now is the time to order so that you can get the use of your car during the best motoring season.

So see these cars at our dealers' showrooms. If you look them over carefully, we are sure the cars will more than bear out our every claim. Again we say, compare them with other cars—point by point—price by price—value by value. Your verdict is sure to be favorable.

And don't forget to send the coupon for the booklet "Story of the Chalmers Car," and our new catalog. You will find this book about the making of an automobile both entertaining and worth while, no matter what car you decide to buy. Just mail the coupon today.

Please send "Story of the Chalmers Car" and complete information regarding the Chalmers 1913 cars.

Name ____________

Street ____________

City ________ State ________

Track Laying by Machinery

THE modern track laying machine should not be confused with track laying tools, as this machine is not a tool, but a real machine that actually lays tracks as indicated in the accompanying photograph. The machine moves steadily forward over the track it lays at a rate of from twelve to forty feet per minute. At the rear of the track laying machine are cars loaded with ties and rails. The cars which carry the ties are in advance of those carrying the rails. The rails are drawn forward on rollers and are connected temporarily one to the other. As the rails pass under the cars which carry the ties the latter are distributed upon the rails and spaced apart uniformly. The chain of rails thus serves to transport the ties toward the track laying machine. As the rails enter the machine, the ties are picked up by a conveyor and carried overhead. They are distributed on the roadbed at the end of a truss that reaches far in advance of the main body of the truck laying machine. The rails in the meantime are carried forward and deposited upon ties previously laid. The truss may be swung to one side or the other in order to allow for passing around curves. The track laying machine is self-propelling. It hauls a train of twenty-five cars of material, more or less depending upon the grade. A train of twelve cars will carry enough material for a mile of track. This machine, with eighteen men, including spikers, can lay and bolt and spike a half a mile of track per day. With a larger force of men two miles of track may be laid in a single day.

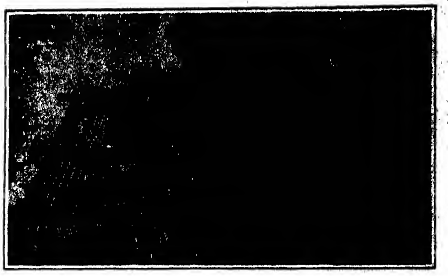
The Wreck of the "Schwaben"

AFTER making a total of 384 flights, in which it covered 28,000 miles and carried 6,045 passengers, the "Schwaben," the first of the huge Zeppelin airships to make regular passenger trips, came to grief on June 28th while anchored outside of the obsolete shed at Dusseldorf in a heavy wind. So much did the airship bob about in the maelstrom that Capt. Duerr decided to go aloft and ride out the gale. He was just about to cast off the mooring cable at the bow when the nose of the ship burst into flame, and he and his crew jumped for their lives. The flame soon ran the entire length of the airship, and she was consumed as she swung at anchor, the fall to the ground breaking her back, as shown in the photograph. The cause of the catching fire of the "Schwaben" in this mysterious manner is thought to be the working of her frame at the bow, where she was tethered. This is believed to have generated frictional electricity sufficient to have ignited the gas. That the cloth covering of the dirigible also had something to do with the generation of this frictional electricity is shown from the fact that the Zeppelin engineers are perfecting a "neutralized" cloth that cannot be electrified. The airship was insured for $162,000. She had made for her owners her entire cost of construction and operating expenses by carrying passengers. The latest Zeppelin, "Hansa," has shown a speed of 49 miles an hour, and the new naval one now building, with 600 horse-power, is expected to travel 60.

An Earth-driven Clock

IN the ordinary clocks provided with weights and springs, the clock mechanism drives the pendulum. In the clock pictured herewith, however, the operation is reversed for the pendulum drives the clock. The pendulum receives its energy from an electro-magnet supplied with current from an earth battery. Because the earth currents are apt to vary considerably, a special automatic switch mechanism is provided to check the pendulum when it swings too far. Thus, a constant amplitude of oscillation is maintained. The pendulum is provided with a bob, consisting of a coil of insulated copper wire, inclosed in a brass case, underneath which there is a similar bob for making the necessary initial adjustment. The terminal wires from the bob coil are carried to the top of the pendulum where they connect to two springs on which the rod is suspended, and then make connection with the earth battery. A permanent steel magnet is mounted on the clock case, adjacent to the bob coil. The poles of the magnet enter tubular openings at each end of the coil. Hence, when current flows through the magnet, there is either an attraction or a repulsion, according to the direction in which the current passes around the coil.

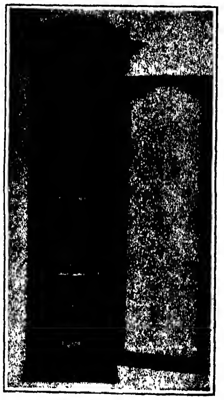
The direction of flow is alternated by a contact gear, which is attached to the pendulum rod. It consists of a small carrier mounted on two wheels that run over a track, secured to the clock case. The wheels run over contacts placed in the battery circuit. The carrier is set in motion by two adjustable contact rods on the pendulum, which push it forward or backward, depending upon the travel of the pendulum at the time. Thus alternate impulses are produced in the coil, which serve to keep the pendulum in motion. To oppose an abnormal swing, the contact pieces are arranged in three parts, so that if the pendulum moves the carriage too far, its wheels make contact with the third members of the contact group and this reverses the current. Recently Prof. Silvanus P. Thompson subjected the clock to a number of tests. In his report he states that if he purposely gave the pendulum a large impulse so that it swung too far, the automatic action of the contact device became evident at once, and after a few swings, the pendulum returned to its normal swing.



Laying track by machine at the rate of two miles per day.

A coal-milling machine.

The tangled wreckage of the Zeppelin dirigible "Schwaben."



General view of the clock

The contact gear.

The exciting coil.

Clock driven by earth currents.

A Machine That Enables Coal to Be Pumped

NO industry is more prolific of disaster, both distressful and costly, than coal mining, and no other industry of this country, owing to the crude methods employed, imposes such hardships upon the workman immediately engaged in taking coal from the vein. To alleviate these dangerous conditions J. H. Hoadley and W. H. Knight have developed a system of mining coal by machinery.

Primarily designed to cut the whole seam of coal into a granular state suitable for coking, this coal-milling machine may modify the art not only of mining coal, but of transporting and consuming it. It is well known that granular or powdered coal, with the aid of water, can be pumped through pipes at far less cost than it can be transported by rail. It is also certain that powdered coal, when blown into a furnace with an air blast, burns with much more economy than does lump coal when burned on the grate.

There are, however, 100,000,000 tons of coal coked each year in this country, and it is with especial reference to this kind of coal that the inventors have directed their attention.

The milling machine not only cuts the coal from floor to roof into a finely powdered state, but pumps it, mixed with water of the mine, to a distant coal washer or to coal bins adjacent to the coke ovens. It necessarily does away with the use of explosives, and with the coal dust. The system is a peculiarly safe one to use in gaseous mines on this account.

The machine itself is automatic, advancing by a simple hydraulic feed mechanism which propels it along the floor into the face of the seam, the rotary cutters on the armature shaft of the induction motor cutting the coal very much as a circular saw cuts wood. The motor is given, in addition to its forward movement, a sidewise swinging motion through a limited angle so that the proper width may be cut. Any partings are, of course, comminuted at the same time as the coal, and are separated afterward in the washing process. A fire engine hose leading from some source of water under pressure enables a powerful stream of water to be thrown against the face of the coal while it is being cut, thus eliminating all dust and keeping the tools cold. The water carries off the comminuted product to the nearest sump, whence it is pumped to any desired destination. The machine, owing to its power of advancing directly into the coal, will cut a slope, an entry, a room, or work along the wall.

Trade-mark as a Business Asset

By W. E. Woodward

THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.

The following is the sixth of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

Analysis of the Requirements for Registration.—VI.

(Continued from page 121, August 10th, 1912.)

The U. S. Sanitary Manufacturing Company was refused registration for a trade-mark consisting of the letters "U. S." with a background of a shield similar to that of the conventional United States shield. The coat of arms for the United States is not registrable as a trade-mark even under the ten years' clause. It has been held that its use in that connection is opposed to public policy. (American Glue Company, ex parte, 120 *Official Gazette*, 324.) The registration of the coat of arms of the State of Maryland was refused registration, application having been made under the ten-years' clause. In another case, registration of a simulation of the shield of the United States, with alternate red and white stripes, was refused registration.

It would seem at first consideration that if the object of using a trade-mark is to indicate the origin of a commodity, the most effective marks would be simply the maker's name—"James Brown" for goods made by James Brown, and "William Jones" for goods made by William Jones. This logic would be indisputable if there was a different family name for every individual. But names are limited in number—there are eleven pages of Smiths in the New York city directory—and every man has a natural and inalienable right to use his own name. But a personal name may be written, or printed, or stamped in such a way that the peculiarities of writing, or printing, or design, may dominate the name and be the most conspicuous feature of the combination.

The trade-mark act provides that "no mark (shall be registered) which consists merely in the name of an individual, firm, corporation, or association, not written, impressed or woven in some particular or distinctive manner, or in association with a portrait of the individual." In this clause the framers of the act have endeavored to put a logical restriction on the injudicious use of personal names as trade-marks and the endless litigation that has always resulted from this practice.

The names of historical personages (not living) may be registered as trade-marks, but the name of a living person cannot be used without his consent. The phrase "Gibson Girl," as a mark for shoes, was refused registration, as the word "Gibson" obviously referred to Charles Dana Gibson, a living artist. In case of the registration of the names of individuals, firms or corporations, the restriction of the law that the name must be shown in some "particular or distinctive manner" has been interpreted to mean a presentation of the name in such a form that the peculiarities of lettering, or writing, or of an accompanying device are so pronounced that they dominate the name and throw it into a position of secondary importance. The meaning of this clause is best shown by means of examples of proper names, registered and used as trade-marks.

Many portraits of living persons are used as trade-marks, notable among them being the face of W. L. Douglas, shoe manufacturer, and the portrait of Thomas A. Edison, used in connection with his facsimile signature, as a trade-mark for Edison phonographs. Among historical characters, the picture and signature of Robert Burns, the poet, are combined in a trade-mark for cigars; the face of Benjamin Franklin is used as a trade-mark for the *Saturday Evening Post*, and will be found printed on the editorial page of each issue; Bismarck is a name for collars; Napoleon is used in connection with a brand of flour, and "Bob" Ingersoll is the trade-mark of a cigar.

It is a definite principle of the common law that fraud vitiates any transaction that it touches. A trade-mark that is deceptive and misleading cannot be protected, no matter if its registration should be accomplished. "Knights of Labor" was refused registration as a trade-mark for whiskey as the evident intent of the mark was to mislead purchasers into a belief that the whiskey was produced by the Knights of Labor, a labor organization. A similar case is exhibited in the attempt to register the name "Masonic" as a mark for cigars. Registration was refused. The name "Malt Myrrh" was refused registration as trade-mark for malt liquors when it was shown that the liquors did not contain myrrh. The name "Old Country Soap," used in connection with soap in such a way as to lead purchasers to believe that the soap was manufactured in Europe, was held by the court in the case of Wrisley v. Iowa Soap Company, to be deceptive, and protection against infringement was refused.

A false representation on a trade-mark to the effect that the article is patented, when it is not, is sufficient to vitiate the trade-mark. A trade-mark registration does not protect when it is used on an article different in character, or composition, or origin, from that for which it was registered. This principle is very important. A manufacturer cannot do as he pleases with his trade-mark without regard to the rights of the public. If the article for which it was registered is changed essentially in composition, or in purpose, the trade-mark ceases to be of value. Trade-marks under the United States law are always specific and associated with a certain definite article, and not with the proprietor's general business. In Great Britain and Canada there are general trade-marks, which the manufacturer may use on any article he makes, no matter to what diverse classes these articles belong.

A trade-mark which is technically a valid mark, will be refused registration if, in the opinion of the Patent Office, its registration would be opposed to public policy. A few examples will show what we mean. The phrase "Ask the Revenue Officer" was rejected as a mark for whiskey. The Patent Office held that this mark, appearing on bottles or barrels, would lead the public to believe that the contents had the endorsement of officers of the government. For similar reason the word "Government" was refused registration as a mark for loose-leaf binders. The name of a living ex-President cannot be registered without his written consent (as in the case of any other living person), and the name of an ex-President not living cannot be registered at all. The use of the name of an ex-President as a trade-mark is not considered consonant with the high dignity of the presidential office. Several applications have been made within the last few years for registration of the names or portraits of ex-Presidents. The signature and portrait of Thomas Jefferson, combined in a trade-mark for cigars, was refused registration. The words "Roosevelt Rose" were rejected on application for registration, the rejection being partly because "Rose" had been registered on a previous application, and partly because Roosevelt is a living person.

A trade-mark cannot be a color, because the number of colors is limited, and it would be manifestly unfair to give the exclusive use of a color to any individual.

The use of the flag or coat of arms of any foreign power is prohibited as a trade-mark. This restriction holds even when the foreign power agrees to the use of its insignia. The Russian Government consented to the use of its coat of arms as a trade-mark in the case of an applicant before the United States Patent Office, but registration was refused. The law is mandatory, and is not affected by agreement.

Any design or picture which has been adopted by a fraternal society as its emblem is not registrable as a trade-mark. For obvious reasons, scandalous or immoral matter is refused registration. A trade-mark cannot be a shape, or a package, or a container. A trade-mark cannot be the article of merchandise itself, for the "mark" must necessarily be different from the thing marked.

Proposed Amendment to the Trade-mark Law.

An amendment to the Act of 1905 is before Congress. This amendment, which will, in all probability, become a law, denies the right of anyone to register as a trade-mark any mark which consists of "any name, distinguishing mark, character, emblem, colors, flag or banner, adopted by any institution, organization, club or society which was incorporated in any State in the United States prior to the date of the adoption and use by the applicant." This proposed addition to the law is the result of an attempt of certain manufacturers to capitalize the prestige of various well-known clubs and other organizations. A case in point was a recent attempt to register the initials "Y. M. C. A." as a trade-mark. Another flagrant case was the adoption of the emblem of the New York Athletic Club—a winged foot—as a trade-mark by a manufacturer of men's clothing. On formal protest by the New York Athletic Club, the registration of this mark was held up.

The Trade-mark Status of Patented Articles.

A patent may be defined as an exclusive monopoly in the manufacture and sale of a new and useful invention granted by law for a term of years to the inventor. As an offset to this monopoly, granted to the inventor as his reward from the public, the inventor's exclusive right ceases at the expiration of the patent, and any one may manufacture and sell the invention.

It would be manifestly unfair to the public if the owner of the patent could, at its expiration, still retain the exclusive right to use the name and trade-mark under which the invention has been sold. If this were permitted, the effect would be a partial continuance of the monopoly. The name and trade-mark belong to the article—not to the individual—and the right to use them goes with the right to manufacture the article.

The Singer Manufacturing Company, when the patents on its sewing machine were about to expire, adopted as a trade-mark the word "Singer" blended with a device. The effect of this action, if the validity of the trade-mark had been sustained, would have been to perpetuate the right to the exclusive use of the word "Singer" as applied to sewing machines. In this event, at the expiration of the patents, any person would have the right to manufacture Singer machines, but only the Singer Manufacturing Company would have had the use of the name "Singer." It was held by the courts that the right to use the name "Singer," as applied to machines of this particular design, became public property when the patents expired. The court said, in the case of Brill v. Singer Manufacturing Company (41 Ohio Stat.):

> "A patentee or his assignee, by incorporating into his trade-mark the distinctive name by which a patented machine has become known to the public during the existence of the patent, cannot, after the expiration of the patent take away from the public the right of using such name. The trade-mark cannot be made a guise for extending the monopoly, or preventing the name from becoming, with the patent, the property of the public."

The Singer case is typical of cases of this character. In the case of Dover Stamping Company v. Fellows (163 Mass 191, 194, 196) the court said

> "When one who has a patented article gives to it and puts upon it a name, and calls it by that name and no other, and it becomes known to the trade and to the public exclusively by the name so given to it by the patentee or person controlling the patent, then certainly it may be said that, as a general rule the right to the exclusive use of the name ceases with the termination of the exclusive right to make and sell the thing."

(To be continued.)

Notes for Inventors

A New Patent Office Publication.—The United States Patent Office has issued a volume of nearly 500 pages, being a supplement to the manual of classification and termed "Definitions of Revised Classes and Subclasses of Subjects of Inventions." The purpose of the publication is to explain what is comprehended within the title of the subclasses established by the Patent Office and it will prove a valuable aid to the practitioners before the Patent Office.

An Anti-skid Improvement.—Rikichi Himeno of New York city, has patented, No. 1,030,238, an anti-skid device which includes two side chains to extend alongside the wheel tire and cross chains connecting the side chains at intervals. One of the side chains is separable at a point intermediate its length to divide it into two sections and means are provided for connecting and disconnecting its intermediate separated ends, the ends of both side chains being provided with means for connecting the same.

Another Peter Cooper Hewitt Lamp.—Peter Cooper Hewitt has secured another patent, No. 1,030,178, for a mercury vapor lamp in which is provided a highly exhausted chamber in the shape of an inverted U, which has a main light giving portion of uniform diameter and is expanded at each end into enlargements which are partly filled with mercury constituting electrodes. A condensing chamber is centrally located along the tubular portion to regulate the vapor pressure within the container.

Legal Notes

Public Use Proceedings.—Public use proceedings are initiated upon the petition of some person or persons believing they are in possession of evidence showing that the invention forming a part of the subject-matter or the entire subject-matter of an application for patent filed by another, was in public use or on sale more than two years prior to the filing of the application for patent. This question of public use is the only material one involved and in a recent case of *ex parte* Wenzelmann and Overholt, Mr. Billings, the first assistant commissioner, has held that a public use proceeding is not instituted to determine when the party filing the petition made the invention or whether he ever made it and that the sole question to be determined is whether the invention was in public use more than two years before the applicant filed his application

A Copyright Treaty Between the United States and Hungary.—The pirating of a play from the Hungarian and produced with much success in this country is said to be at the bottom of a copyright treaty recently concluded between the United States and Hungary. The treaty gives Americans the right to secure literary, artistic, dramatic, musical and photographic copyrights in Hungary on the same terms accorded to native Hungarians. In return, full copyright privileges are extended by the United States.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY You will find inquiries for certain classes of articles numbered in consecutive order If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information There is no charge for this service *In every case it is necessary to give the number of the inquiry* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO, INC

Inquiry No 9262 Wanted to buy a glass which is a conductor of electricity, and the address of the makers of the same

Inquiry No 9263 Wanted name and address of manufacturer of pantaloon stretchers with clamps which is capable of being folded up

Inquiry No 9264 Wanted the name and address of manufacturers of date pitting machines

Inquiry No 9265 Wanted the names and addresses of manufacturers of machinery for making picket fences

Inquiry No 9266 Wanted to buy machinery for fastening wire cloth to wooden frames with coppered tacks

Inquiry No 9267 Wanted addresses of manufacturers of metal specialties in connection with plate or window glass

Inquiry No 9272 Wanted names and addresses of engravers and mounters of fine quality maps or plans of large cities Large order

Inquiry No 9273 Wanted to buy a globe for a parlor fountain, working on the Heron system

Inquiry No 9274 Wanted the name of a manufacturer of a machine to make cushion covers for fruit crates

Inquiry No 9275 Wanted name and address of manufacturer of stock patterns of platen job printing presses

Inquiry No 9276 Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1 00 to $2 00

Inquiry No 9277. Wanted a machine for packing dry batteries

Inquiry No 9278 Wanted a machine for separating crab meat from the shell

Inquiry No 9279 Wanted a machine for shredding asbestos board

Inquiry No 9280 Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears.

Inquiry No 9281 Wanted to buy machinery for bleaching walnuts and ivory nuts

Inquiry No 9282 Wanted name and address of manufacturer of coin-controlled gasoline-dispensing tanks for automobile use.

Inquiry No 9283. Wanted name and address of dealers in powdered Cocoa and Kola nuts in bulk.

Some Plastic Agglutinants

THE word "plastic" expresses the quality of bending, yielding, or flowing under pressure. Plasticity is a condition of fluidity, although it may be something more. Many metals are plastic; the flow of glaciers is due to the plasticity or fluidity of the component ice; the earth itself, in fact, flows or moves under pressure. Fibrous substances are not plastic, that is, they do not flow under pressure. Plasticity may be of a permanent character as in the case of asphalts and bitumens, lead and ice, or it may be only temporary as is the case with bodies having setting qualities, as plaster of Paris, caoutchouc and sulphur, phenol and formaldehyde, or clay before and after burning. In many instances the plastic agent is used with a filler of some inert material. That is, our plastic body is not only made to take some desired shape but it has to carry particles of some other material with it. Thus, a concrete block is a mass of gravel and sand held together by the cement; a piece of linoleum is a mass of cork dust held together by a set binder of linseed oil and sulphur or oxygen. The plastic substance must then have also agglutinating qualities, i e., it must adhere to the particles of whatever materials may be put with it.

This opens up a large subject. If the filler is of dense material like sand, say, the binder will hold such particles by mere surface adhesion. If the filler be porous, the particles become saturated with the binder and may be said to be anchored thereby, like particles of cork in linoleum or cellulose fiber in heavily sized paper In the first instance, the binder merely fills the voids between the particles of filler. In the second, the filler floats, as it were, in a saturating menstruum. If the first is of a kind that shrinks on setting or drying, it can not pull the particles completely together, and must either put itself under molecular strain or it must leave voids or openings in its mass. In the second instance, if the agglutinant is one that shrinks, the whole mass is merely pulled closer together or reduced in size; that is, the object shrinks on drying or setting.

Binders With Hydraulic Qualities.

Agglutinants or binders are of many kinds and uses Of one familiar type are those which have setting or hydraulic qualities. The most prominent exponent of this type is Portland cement Like all cements it has the property of setting, i e., absorbing water, and by means of this becoming hard and coherent The water in this instance becomes a part of the mass and helps to form a hydrated silicate or perhaps several, the exact nature of which is still somewhat in dispute.

Another common binder is plaster of Paris. This also possesses the property of hydrating Its uses in the arts are numerous, the most common being as an ingredient of wall-plaster, where it is combined with various agents for controlling or retarding the rapidity of its setting Mixed with alum it forms the material known as Keen's cement, from its discoverer—the alum making the plaster harder

Another binder is magnesium oxychloride When magnesia is mixed with a solution of magnesium chloride it forms a compound, an oxychloride, which is quite hard and wears well. It is a principal ingredient in many compositions for composite floors—in bathrooms, kitchens and similar locations. It has been proposed as a binder for fuel briquets

Linseed Oil and Vegetable Binders.

The number of binders of vegetable origin is legion. Probably the one most used is linseed oil If this oil be given a sufficient supply of oxygen it oxidizes into a resinous body—dries, as painters say. This drying can be accelerated by supplying it with an oxygen-transferring body—a catalyzer, lead oxide is the one generally used. The molecules of this will give off oxygen to the oil and in turn will take others from the surrounding air. Linseed oil is the main binder in linoleum, which consists mainly of ground cork held together by oxidized oil. Various mineral or vegetable fillers are added and, of course, coloring matter. Other oils have the same quality, one, Chinese oil, derived from the nut of the tung tree, in a degree even greater than that of linseed oil. This phenomenon of hardening is also in part the result of a polymerization—perhaps in several stages; that is, the molecules, at first of comparatively simple structure, unite to form molecules of more complex structure.

Gluten, gum arabic, dextrine, are also occasionally used, though their use is mainly that of simple adhesives. They are too brittle and too easily solvent to be very efficient as agglutinants. Starch is another often used. When boiled with alkali it acquires better adhesive qualities. These have no hardening qualities

Animal Agglutinants.

Glue or gelatine, casein and albumen are the animal agglutinants. These can all be hardened, i. e., rendered insoluble by treatment with various agents. Tannic acid is the oldest and best known for glue. It converts the soluble glue of the hide into an insoluble tannate which can only be broken up by prolonged treatment with alkali. Formaldehyde is another. Chromic acid, or compounds containing it, is another. These adhesives generally form the vehicles of the various sizes for paper, cloth, yarn and kalsomine. It may be stated here that the binders we have been discussing are nearly all to be found used as vehicles for pigments. A paint is more nearly liquid than the so-called plastic compositions hitherto discussed, but it consists essentially of a body of coloring matter—pigment, suspended in and held in place by a suitable menstruum. The menstruum becomes hard through the evaporation of a solvent, and through the resinification of the vehicle. Plastic and coating compositions are essentially the same and are in fact often interchangeable.

Cellulose Fiber in the Arts.

The most universal product of vegetation is cellulose fiber. If we separate fiber from the gums, resins and pectoses with which it is arranged in the structure of the plant we get, of course, pure cellulose, and if this mass of fiber be beaten, matted or felted together into a sheet or layer we get approximately pure paper, like filter paper or blotting paper. Cellulose fiber is insoluble in water, but if the fibers be pressed, crushed, rubbed together in water for a long time, hydration of the cellulose can be carried to such a degree that the filler breaks down and becomes a slimy mass which will dry bone hard. If a sheet of paper be heated in a concentrated solution of zinc chloride it is gradually dissolved. If this solution be squirted through a fine hole into alcohol a firm thread is produced which may be carbonized to make carbon lamp filaments. If the sheet of paper be incompletely gelatinized it becomes, after suitable treatment, vulcanized fiber. If a sheet be passed through sulphuric acid it becomes vegetable parchment. If a solution of cellulose be treated with carbon disulfid, a soluble syrupy compound is formed which separates into its constituents—alkali, carbon disulfid and cellulose. The amorphous cellulose thus obtained is known as viscose. It is used in sizing pulps and generally as a carrier or vehicle for coating paper and fabrics. It is also combined with cork, leather, etc., to form plastic masses. It may also be drawn into fine threads or filaments They are somewhat used as substitutes for silk but are weaker when wet than other artificially made filaments. They are not especially inflammable.

If a mass of pure fibrous cellulose be treated with a mixture of nitric and sulphuric acids there results a nitration of the cellulose and formation of nitrocellulose. The nitration may be carried to a varying extent, the N_2O_5 (nitric oxide) radical replacing the H in the cellulose, the mass formula of which is given as $C_{24}H_{40}O_{20}$, to any number, from one to twelve. Since N_2O_4 represents a strong oxidizing radical the higher nitrates are very rich in oxygen. They are therefore useful as explosives, gun cotton and smokeless powder containing them. The lower nitrates, while inflammable, are not readily explosive. When dissolved in suitable solvents, such as acetone and amyl acetate, they become the bases of pyroxyline compounds. Celluloid is nitro-cellulose mixed with camphor. It is not affected by moisture and it may be transparent if a proper solvent is used. It is useful as a varnish, though the objection to it here is that it does not stick readily to wood. It is used in the manufacture of buttons, combs and ornaments of various kinds, in making which it is generally mixed with a heavy charge of filler.

A solution of nitro-cellulose may be spun or squirted in the form of a fine filament from a suitable orifice into some medium which will dissolve or withdraw the solvent. This produces so-called artificial silk. A similar process is employed for making artificial horsehair and whalebone.

The Celluloid Industries.

Celluloid when deposited from many solvents is transparent. In thin sheets it is as transparent as glass without the slight greenish tinge which most glass, in the opinion of experts, imparts to objects seen through it. The fact that it can be made in bands of indefinite length renders it especially useful for picture films. These films are usually made by allowing a proper solution in a volatile solvent to fall upon a moving band or wheel. As the solvent evaporates, the film acquires coherence enough to let it be lifted off, dried and trimmed. It may be coated then or later with the proper sensitive emulsion. There are said to be three hundred moving picture theaters in New York alone, there are two hundred in Berlin, as many in Paris, and more in London. The demand for this purpose is said daily to amount to almost 600,000 meters—in value over a hundred thousand dollars. These films are inflammable to a high degree however. This has led inventors to attempt to find suitable substitutes. The best of these is probably cellulose acetate—a compound corresponding to cellulose nitrate with a corresponding change of acid. This changed result is attained usually by acetating hydrated cellulose and dissolving the product and treating as with nitro-cellulose. The cost is almost ten per cent higher but the product is not dangerously inflammable. It will, of course, burn like all organic substances, but it is no more inflammable than so much wood.

Chemists in certain German laboratories have been engaged for years in the analysis and synthesis of caoutchouc with a view to its commercial production. If vapors of turpentine be passed through a heated tube and condensed by a spray of hydrochloric acid, or the vapors be condensed and agitated with hydrochloric acid, solid caoutchouc (polyprene) will be formed. Another method recently discussed in this journal starts with starch, which, by fermentation, is partly converted into fusel oil, i. e., the higher alcohols These, by subsequent treatment, are converted into isoprene, which changes readily into polyprene. This seems easy, and there are other processes which seem just as easy, but natural rubber either from plantation or from forests is still the main source of supply. A limited supply is obtained in the southern part of the United States, and from Mexico, from a desert shrub called the Guayule. All natural rubbers contain a varying percentage of resins and gums other than rubber—and Guayule is no exception. The purest in this respect is that known from its principal place of export as Para rubber. There are more than one hundred and fifty plants from which rubber of one grade or another is derived.

Crude rubber is of little use as such. It is too soft and runny. It is usually compounded with sulphur, which hardens and fixes it. The product, according to the proportion of sulphur used, is known as soft or hard rubber. Rubber is ordinarily adulterated with a large per cent of substitutes and is charged with a variety of fillers.

There are so-called rubber articles made which do not have one per cent of pure new rubber. They have rubber substitutes—oils, particularly corn-oil, and reclaimed rubber, with various other cheaper mineral or vegetable diluents.

It is used rather for its elastic, insulating and waterproofing qualities. It is not preeminent as agglutinant merely.

Bituminous and asphaltic binders are mostly used in binding aggregates for

street use. The ordinary asphalt street pavement consists of a layer or blanket of asphalt and some fine filler, resting upon a foundation, generally of bituminous or hydraulic concrete or both. The asphalt has no particular strength of its own. It is the roof for the structure below. It must stretch during shrinking by cold, it must shed water, it must not crack, it must not flow when the summer sun beats upon it, and it must give a sufficiently gritty hold to hoof and tire. Asphalt seems well adapted for these purposes. Asphalt is also the basis of many paints, varnishes and japans.

Substitutes for Celluloid.

If a mixture of carbolic acid and formaldehyde be heated an oily viscous liquid soluble in alcohol and acetone will be produced. If this be heated under pressure at a temperature above the boiling point of water, a hard, brittle, insoluble, infusible and otherwise refractory substance will be produced. If the treatment is stopped before reaction is complete, the result of the reaction may be powdered and placed in molds and again heated. This is the substance known as bakelite. Other similar products are on the market. This product lacks the elasticity of celluloid, but it is harder and is incombustible as well as infusible. It may be combined with fillers of various kinds, and for many purposes is obviously better than celluloid.

In cork-soled shoes the bottom of the shoe is filled in with a mixture of ground cork and gutta percha or similar gum and a suitable solvent. This is d fficult to work, is expensive, and the solvent makes it inflammable. Wax tailings, a residuum of petroleum distillation modified by various agents, has been successfully used instead. It is said to obviate many of the objections to which the gutta percha or similar binding agent is liable.

The foregoing indicates to some extent some of the most used plastic agglutimants. It would be easy to extend the list. The fillers being for the most part neutral, no discussion of them has been attempted. The same binder may be used for making artificial stone for carrying a wall pigment, for laying the dust on a highway, or for making a fuel briquet.

Recent Research on Lubrication for Gasoline Engines

By Theo. M. R. von Keler

THE lubrication of gasoline engines presents a problem materially different from that which confronts us in ordinary steam engine practice. This is immediately evident when we consider that the temperature in the cylinder of a steam engine may at most reach about 500 deg. Fahr., while in an internal combustion engine it rises as high as 2,640 deg. Fahr. Added to this is the fact that the piston speed in a gasoline engine is considerably greater than in a steam engine. Just what happens to the lubricating oil in the operation of a gasoline engine is not precisely known, but there can be no question that a considerable portion of it burns and is discharged in the exhaust. How much of the oil is destroyed, and how much remains to do its duty as a lubricator, depends on the composition of the lubricant, and the cooling arrangement of the motor.

There is no doubt that the destruction of the oil by combustion cannot be averted; a certain quantity of the oil *must* burn, and *must* find its way in this burned state into the exhaust pipe. If this combustion can be made complete, in so far as the burnt part of the oil is concerned, it follows that there will be less residue and less "smoke." A very thick oil, composed of fractions with a high boiling point, naturally will be only partially burned, which would explain the almost universal demand that cylinder oil be medium thick and possess a comparatively low boiling point—just the opposite from what the average driver or owner of a car would imagine would be necessary. The part of the oil which burns, must burn completely and should not leave a carbon deposit in the cylinders. The more carbon there is in the oil, the more oxygen is necessary to complete combustion. Oxygen, however, in a gasoline motor is a precious substance and practically the entire supply drawn into the cylinder on the suction stroke is needed for the combustion of the gasoline itself. The small quantity not thus employed is sufficient for complete combustion of the oil only when the latter does not contain too much carbon.

A series of tests has just been completed at the Royal Experiment Station for Testing Materials at Berlin, Germany, which disclosed some unexpected and highly valuable properties of oil of different chemical composition. The oils examined were separated into two portions by extraction with acetone, which dissolves the heavier constituents of the oil. It was found that "treated" oils, that is to say those from which the heavier portion had been extracted with acetone, gave an exhaust free from irritating odor, while the untreated oil, under similar circumstances, gave rise to pungent smoke, highly irritating to the nose and eyes. It is thus conclusively shown that the offensive products in the exhaust are due to the heavier constituents of the oil.

These tests show also that the various means taken or proposed which are to do away with the nuisance of smoking automobiles do not attack the problem from the correct point. It is not so much a question of absorbing or deodorizing the exhaust gases, as of a proper selection of the oil best suited for the particular motor in which it is to be used. And this selection should not be made by some sort of "rule of thumb" method, but by a careful analysis based on the acetone method. Once decided upon as the best, the oil selected can undoubtedly be obtained from the manufacturers. It would even be possible to divide the oils into specially light ones for automobile use, and heavy ones for steam engines—or to treat them with acetone before marketing them.

Aside from the treatment of lubricating oils with acetone, the science of chemistry knows of no method of analysis at present, which permits of a correct valuation of lubricating oil for combustion motors. Research is going on in practically every large laboratory, and especially in the great automobile factories and oil refineries, but so far no satisfactory method has been found, by which the quality of an oil for automobile use can be ascertained in the laboratory. It is, however, expected that further tests along the line of acetone treatment will evolve a fairly easy, and yet trusty, method of judging the suitability of the various kinds of lubricating oil for automobile use.

[The foregoing is an abstract of a paper of a more technical character, which is published at length in the current number of the SCIENTIFIC AMERICAN SUPPLEMENT.—EDITOR.]

Temperance Beer

IN prohibition States or localities a non-alcoholic malt beverage has been put on the market. This so-called temperance beer must contain less than ½ per cent of alcohol by volume, or it will be subject to the United States internal revenue tax. (See Treasury Decision, No. 1,360, May 19th, 1908.) The aim has been to manufacture a temperance beer containing all the ingredients of normal beer except the alcohol, and which shall resemble it in color, flavor and taste as nearly as possible. There are several methods of making temperance beer. Alcohol is removed from normal beer by methods of careful distillation at low temperature. Hot air or carbonic acid gas is blown through the beer to distill off the alcohol. In this connection the sensitiveness of the albuminoids above referred to should be remembered. After cooling, the non-alcoholic beer is recarbonated with carbonic acid gas. Another method is [illegible]

manufacture in such a manner as to keep the alcohol below ½ per cent. This may be done by stopping the fermentation, sterilizing and recarbonating. Still another method is by mixing normal beer, beer wort and water in proper proportion and carbonating. It is difficult to make a temperance beer that will taste like normal beer, and its keeping qualities are poor. Moreover, the manufacture of good temperance beer is more expensive than that of normal beer, because of the additional manipulations required. It has occurred, therefore, that retailers have sold normal beer for temperance beer and got themselves into trouble by doing so. Probably this is the only instance where a dealer was legally prosecuted for selling the genuine article for the alleged substitute, and this in face of the fact that the consumers made no complaints, but were perfectly satisfied.

The Road Congress

SCIENTIFIC management as applied to the nation-wide problem of building and supervising public roads is to be the keynote of the American Road Congress, to be held on the Million Dollar Pier in Atlantic City, September 30th to October 5th.

The movement for better roads has taken root in every State in the Union. In every community there are men laboring for better roads. The trouble with the movement has been its lack of definite plans and methods for handling the immense problem. The plans and methods are provided at the Atlantic City Congress.

It is not merely to create enthusiasm for an improved system of public roads that the congress is to be held. The enthusiasm is already at hand. The purpose of the congress, which marks the consolidation of the convention interests of the American Association for Highway Improvement, the American Automobile Association and the National Association of Machinery and Material Manufacturers, is to deal with every phase of the road subject in an orderly and scientific manner.

The people of the United States are now spending, for instance, more than $150,000,000 a year on their roads. It is known that they are not getting a full dollar's worth of good road for every dollar expended. In other words, many millions of dollars expended for roads are actually wasted every year because of unscientific methods. Some communities do not build the right kind of roads. Some build roads designed for light traffic and expect them to withstand heavy traffic, and some build expensive roads where inexpensive ones would give better satisfaction. Much of the trouble is due to the fact that there is an absence of scientific supervision of construction and maintenance. There are more than 100,000 officials of more or less importance engaged in the work of supervising the roads of the country, and many of these officials are engaged for political reasons, and not for their ability or competence.

At the American Road Congress civil service will be thoroughly considered in its application to road management. Gen. John C. Black, chairman of the United States Civil Service Commission, will make one of the addresses on this subject. He will explain the importance of putting the civil service, or merit test, to every man having anything to do with the supervision of the roads.

Every other phase of the road subject will be handled in the same scientific manner. The most eminent bankers will discuss methods for safeguarding a proper accounting of taxes and assuring business methods in obtaining loans or making bond issues to build good roads. There is to be a legislative section which will endeavor to point the way to needed reforms in road legislation. The president of the American Bar Association is lending his assistance in preparing the programme for this particular section of the congress.

In conjunction with the congress, there will be a conference of educators with a view to having highway engineering introduced in colleges on a scale that will meet modern requirements. Engineers experienced in road building are not plentiful, and if the colleges could be induced to introduce the right kind of courses, one of the greatest needs of the road movement would be supplied.

It is believed by President Taft, who is the honorary president of the American Road Congress, that better roads mean greater happiness not merely to persons living in the country districts, but to every human being in the country. Better roads mean that the farmer can haul his products at all seasons of the year, doing away with the railroad waste of pulling empty cars back and forth at certain seasons of the year, lowering the general cost of transportation, and finally resulting in a cut in the cost of living to the consumer. President Taft, who is to make an address at the opening of the congress, will point out that the improvement of public roads is the best investment that the American people can make. Of equal interest will be the address to be made by Governor Wilson of New Jersey.

The American Road Congress will be notable in that it will mark the evolution of the road movement from the theoretical to the practical stage. Each phase of the big subject will be handled by the foremost men in that particular line of endeavor. It is felt that scientific management is as applicable to a great subject of this kind as it is to the business of a great corporation. Logan Waller Page, director of the Office of Public Roads, and active president of the congress, believes that the gathering in Atlantic City will put the road movement on such a basis that the time will not be long distant when twenty per cent of the public highways will have been improved. Mr. Page estimates that the improvement of twenty per cent of the roads will bring this nation's road system to a high point of efficiency, almost equal to that of France.

A Substitute for Wood

THE steadily increasing price of timber in Europe has caused interest to be centered in a French invention for preparing a substitute for this article. The process is very simple and inexpensive, the whole process of manufacture being carried out by a single machine. The inventor, Monsieur Carré, associated with the champagne industry, embarked upon this task with a view to preparing an efficient and cheap substitute for packing the bottles of wine, as well as the cases which at present are made of wood, and the cost of which is persistently rising. The first experiments were made about five years ago, and recently some excellent specimens of the substitute have been produced.

The material used in this process is straw. The straw is first split lengthwise [illegible] the resiliency in the stalk. The ripped material is then placed in the machine together with certain ingredients, being laid upon a traveling plate. The latter is kept at a certain uniform temperature by means of steam, so as to cook the straw and the substances associated therewith. When this stage has been carried to the requisite degree intense pressure is applied the results of which are to knit or compress the fibers of straw very closely and tightly together, to form a homogeneous mass. A pressure of between two and three tons per square inch is required in order to produce the best results, and the fabric issues from the machine in continuous lengths of the required thickness and width to be sawn as desired.

In general appearance the material resembles whitewood, the compressed straw

imparting a straight grain-like effect. It works fairly easily, and when sawn leaves a clean cut. Its strength is comparable with the ordinary whitewood, and it can be applied to all purposes for which the latter is fitted. In the preparation of the greater thicknesses such as for joists or posts the better practice is to build up the baulk with layers about a quarter of an inch in thickness laid transversely. Tests with the material have shown that when the cooking and pressing operations have been carried out accurately, the fabric will not disintegrate, and responds readily to the application of tools, though being somewhat denser than whitewood it is harder to work across the grain. It does not split readily when nailed, and should, therefore, prove highly serviceable for making packing cases.

One highly useful application of the invention has been found. This is the production of cordwood for burning purposes. Efforts are being made to introduce it into the Canadian West on the wheatfields of which the straw at present is a waste product, while wood and other fuel is expensive. By means of this machine rough wood suited to burning purposes could be prepared very cheaply. The artificial wood burns with a bright long flame, is practically free from smoke, and gives intense heat, so that it is well suited to steam raising purposes.

The inventor has also devised a means of manufacturing matches from this substitute. This was not an easy matter as the ingredients associated with the raw straw had to be of such a character that they emitted no smell, smoke, and yet burned with a steady flame, as well as igniting readily. Success has been achieved in this connection and an ingenious machine has been devised. In this case the molding plates, both upper and lower, have been corrugated to form round grooves about a millimeter less in diameter than the square section Swedish matches. The plate is made in segments, each of which corresponds to the length of the match, these segments being hinged together so as to travel round the cylinder in the compressing machine, and are ejected in long rows ready for receiving the heads. If desired, however, the matches can be produced in blocks joined together at the lower end similar to the wooden matches that are found in the West, and being torn singly from the block as required.

The matches produced in this manner are similar to the ordinary wooden type, burn readily, while the head and consumed part do not drop off. The cost of manufacturing by this method is less than that of fashioning them from wood, though they are equal to the latter article in every other respect. In the latest experiments the inventor has succeeded in producing an excellent substitute for the wax match, dispensing with the cotton fiber foundation of the latter article.

Another application of the same idea has been the manufacture of a corrugated packing material to take the place of the corrugated strawboard which is used so extensively for wrapping purposes. This product is far stronger than the strawboard article, possesses equal resiliency, and rolls closer when required, so that it constitutes an excellent medium for bottle packing. It is neater and cleaner than the straw packing generally employed for wrapping wines, and after fulfilling this purpose can be subjected to other packing uses.

A Simple and Efficient Canoe Gum

CONSIDERABLE need is often experienced by canoeists and boatmen generally in the lack of a good canoe gum to stop leaks or breaks which may occur in the calking of the boat. When canoeing in the northern waters of Canada or on the lakes in the Adirondacks and the Rockies, it is often inconvenient or impossible to obtain a ready-made gum which will answer this purpose.

A good canoe gum must answer several demands; first, it must be sufficiently pliable so as not to break and powder when in the cold water and under strain, second, it must not melt and run in the sun when the canoe is beached for a short time; third, it must not dissolve or soften when in the water; and last, it must set hard in a few moments if it is to meet the requirements of an emergency. It goes without saying that the raw material must be easily accessible, and the price as low as possible.

All these demands are adequately met by a gum compounded of rosin and vaseline, and the gum can be made in any watertight dish which may be heated over an open fire. One part of vaseline and four parts of rosin, by weight, heated until dissolved in each other will give a gum which, at summer temperature, is soft and easily dented. This is the consistency required for a gum to prevent crumbling in cold waters, such as Lake Superior.

A material compounded of 10 per cent vaseline and 90 per cent rosin is quite brittle when cold. However, in warmer waters farther south, this gum is sufficiently pliable and does not soften or melt readily in the sun.

Addition of rosin makes the gum harder and more brittle, adding more vaseline makes it softer and tougher, so that any consistency may be had from the hardness of rosin to the softness of vaseline.

The above ingredients compounded in the proportions of 10 to 20 per cent of vaseline and 90 to 80 per cent of rosin will answer all the requirements of a first-class canoe gum. It may be carried in a tin or wrapped in paper, and it melts easily over the flame of a match and sticks like glue to warmed surfaces. Any coloring matter may be stirred into the hot liquid gum; for example, Chinese blue gives a bluish green color, red lead gives a brilliant red, and chrome green yields a brilliant green. The best proportions are one part of mineral pigment to one part of gum. The addition of pigments makes the gum very hard.

The Current Supplement

THIS week's copy of the SUPPLEMENT forms a companion issue to the present Chemistry Number of the SCIENTIFIC AMERICAN. Mr. August Neumark, who, by this time, must be known to our readers from several very good articles which he has contributed, gives us the first installment of an article on Nitrous Oxide and its Applications, which will run through two issues.—An article by Dr. Raschig on Soluble Gunpowder touches on an important new development.—Mr. C. C. Hutchins describes the laboratory preparation of quartz fibers.—Welding by electricity is becoming more and more important. Our front page illustration forms part of an article on the subject.—Prof. Gockel writes on the Correlation Between Sun Spots and the Weather.—Mr. Carroll Curtis contributes an excellent article on the *East Coast Fishing Banks and the Preservation of Our Fish Supply*.—One of the most important articles in this issue is from the pen of Mr. von Keler on Lubrication Problems in Gasoline Engines.—Another important subject dealt with is the Manufacture of Ethyl Alcohol from Wood Waste.—Prof. Bone recently delivered a lecture before the Chemical Society at Leeds on his "Surface Combustion Furnaces," which seem to be destined to work a revolution in industrial heating operations. An illustrated abstract of this lecture is published in this issue.—Mr. Johnson describes an ingenious machine for testing iron and steel for their magnetic properties and recording the results graphically.—Using X rays to fit shoes on one's feet may seem at first sight a trivial application, but when it comes to supplying an army with foot-gear, the matter assumes grave importance. An illustrated article tells of a new departure in this direction.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

INNERSOLE.—F. L. COASON, 87 Winter St., Rochester, N. H. The innersole is constructed of unusually thin leather, and is reinforced by a ribbed canvas member sewed to the innersole at each side of the rib, so that when the welt and upper are sewed to the canvas member rib the innersole will be reinforced by the canvas and the strain will be distributed on the innersole at each side of the rib.

Pertaining to Aviation.

AERIAL PROPELLER.—HARRY H. ELLIOTT, Lawrence, Kan. The principal feature here is the propeller's variable pitch alterable at will by operating the lever, wheel or other suitable device, and the blades can be set or adjusted so as to give a thrust or pull or neither, when they are rotated. If the propeller is used on a monoplane and mounted in front to give a pull, its reverse position or thrust will act as a brake in case a sudden stop is necessary or desired. For starting or for excess speed or wherever a maximum thrust is desired, it is instantly obtainable and can be maintained. The neutral position is equivalent to a free engine and makes the aviator independent of personal aid when starting. Construction is exceedingly simple, and only a few minutes are required to "take down" the propeller for packing, which can be done in half the space needed for the ordinary wooden propeller. All parts are interchangeable, and an accident to one part, a blade, for example, can be replaced without obtaining a whole new propeller.

MULTIPLEX POWER FLYING MACHINE.—C. V. JOHNSON, Box 1896, Goldfield, Nev. An object here is to obviate the necessity of any great skill of the aviator in case a motive means should give out, by providing a plurality of motors adapted to drive one or more propellers, so that if one is disabled, the other or others will automatically take up the work, keeping up the aeroplane's speed and thus removing any chance of disastrous results on this account.

Electrical Devices.

OVERHEAD TROLLEY.—R. A. PROLAR, 286 Pope Ave., Toronto, Canada. In this case the trolley rope is wound on a spring-retracted drum which is automatically released when the trolley wheel is displaced from the wire, and whereby the rope is taken up, or wound on the drum, and thus the trolley wheel is drawn down below the wire into position to be easily and quickly reapplied thereto.

ELECTROMAGNETIC DEVICE.—B. SOLDATENKOW, 87 Rue La Pérouse, Paris, France. This invention relates to an electro-magnetic device having a variable action, and it is intended to enable different and distinct effects to be obtained by the action of a single solenoid and a single electric circuit. It can be applied to actuation of apparatus of all kinds, or to the production of electrical, electro-magnetic, or mechanical effects.

PRINTING TELEGRAPH.—B. SOLDATENKOW, 87 Rue La Pérouse, Paris, France. This invention comprises an electro-magnetic device having two distinct actions and provided with a single solenoid by which means it is possible to obtain different and distinct effects. It is thereby possible to reduce the consumption of current, as well as size and cost of apparatus.

ELECTROPLATING APPARATUS.—J. W. DOW, 564 Park Ave., W., Mansfield, Ohio. Mr. Dow's invention relates generally to electroplating apparatus and more particularly it is directed to a new and improved construction adapted for use in depositing metals upon bodies, the construction being especially adapted for use in electroplating small bodies.

Of Interest to Farmers.

SELF PITCHER.—O. D. HUTTO, Russell Springs, Kan. This invention relates to an agricultural machine for taking or gathering grain from stacks and conveying it to a threshing machine or the like. The object of the inventor is to provide a simple machine requiring but little attention for adjustment and operation.

Of General Interest.

DEVICE FOR DEVELOPING PHOTOGRAPHIC FILMS.—DR. W. R. INGRAM, 735 So. 6th Ave., Tucson, Ariz. An object of the invention is to provide a device having a retainer for each film, the retainers being hinged together and so formed that they may be rolled up in compact form, thereby occupying little space and necessitating a minimum quantity of developer.

PIANO SOUNDING BOARD.—F. B. LONG, 724 So. Broadway, Los Angeles, Cal. The invention provides a sounding board for pianos and similar stringed musical instruments arranged to permit of maintaining the original crown and the desired firmness of the structure to insure the production of a well-sustained tone when the piano is played.

CLOTHES LINE SUPPORT.—E. [illegible], [illegible] Ave., New York, N. Y. This invention provides a support on which laundry may be hung out to dry from the window, the parts being managed from within the room; provides means for forming a passageway through the support; provides within the room from which the windows opens to move the laundry to the outer end of the rack; and provides means for forming a central passage through the rack.

ALUMINIUM SOLDER.—C. R. EAKENS, 416 Van Der Venter Ave., Astoria, Long Island City, N. Y. This invention relates to an alloy to be used as a solder for uniting one strip or piece of aluminium to another, or for uniting one piece of aluminium to any other suitable metal. The solder may be used for the purpose stated without the heating of the parts to be united by a blow pipe or otherwise.

DESK.—S. GARAVAGNO, care of D. Garcia, Lagos, Box 5, Montevideo, Uruguay, South America. This desk is of compact form with flexible roll-top and a tilting shelf and occupies a minimum of space and has extensible members to give the requisite area when in operation; is provided with an attachment for latching an extended leaf in operative position; and is provided with means for holding the shelf in advanced or retracted position. It is for use with typewriting machines, stands for automatic music machines, sewing machines, etc.

ADJUSTABLE SCHOOL DESK AND SEAT.—S. MACC. JONES, Box 76, 1425 Superior St., Wilkinsburg, Pa. This invention relates to desks and seats for audience rooms, especially school rooms where it is desirable for the furniture to be adjusted in accordance with the stature of the several persons to use the same. The inventor has found by practical experience that the number of different sizes of school desks made in accordance with his invention may be reduced even more than one half, and yet easily come within the requirements of the law in some jurisdictions.

HEAT INSULATED RECEPTACLE.—R. HARTWIG, 12 Bregenzerstrasse, Berlin, Germany. Mr. Hartwig's invention consists essentially in providing within a vessel a joint adapted to be sealed, and providing this joint with a tensioning device, comprising the insulating ring, near the upper edge of the receptacle, and the inventor prefers to arrange the tensioning device between the inner and outer bottoms of the receptacle.

PROPELLER.—D. H. BLAKE, care of J. W. Happle, Sanderson, Texas. This invention relates to marine propellers, and the aim is to provide a form designed to give increased efficiency in proportion to its size, and to provide in connection with the improved propeller novel means of preventing a vacuum behind the propeller.

VAULT COVER.—H. SELLHEIM, 357 Stockholm St., Ridgewood, Brooklyn, N. Y. This cover is for use for cellars, vaults and the like, and is adapted to form a strong surface which will at the same time permit the passage of light to the cellar or vault below. In this device the transparent members or lenses can be readily removed, for the purpose of renewing the same.

Hardware and Tools.

WIRE ANCHOR.—F. T. REINERT, R. F. D. No. 3, Box 1, Aurora, Ill. This improvement relates to devices for connecting or anchoring the ends of fence wire or the like to posts. The anchor is preferably made of metal which may be of any suitable variety having in view the elements of cheapness and strength, and it may be galvanized for durability and appearance.

TOOL HANDLE HOLDER.—C. BERRY, care of Central Hotel, Grand Forks, N. D. This invention pertains especially to devices whereby a single holder may be used successively for attaching a single handle to various tools of similar or different character, or for the renewal of a broken or defective handle on a certain tool or set of tools such as garden rakes, hoes, forks, chisels, screw drivers and the like.

Machines and Mechanical Devices.

OIL SWAB HOLDER.—C. E. CALKINS, Las Cascadas, Canal Zone, Panama. The holder is the form of a cup constructed in two half sections hinged together so that they may be closed about a piston rod. The covers of the holder have flanges that are caught under lugs on the cup sections. A single screw thus holds the cup together and also locks the cover sections.

CHUCK.—F. J. CORNIL, 223 Cypress St., Argenta, Ark. This invention is a combination chuck whereby thin cylindrical work can be held by pressure from both inside and outside at the same time, thereby eliminating distortion. The jaws, which are reversible can be used in the usual manner, and also for clamping work thereto, said work being centered by lugs, and the clamps forming part of the jaws. A locking device for the jaws is included.

SUCTION WATER MOTOR.—J. O. KAFADER, Fort Bidwell, Cal. The purpose in this case is to provide a motor wherein the difference in height between two strata of the earth is utilized to create a suction adapted to aid in the operation of a motor, which in turn pumps water from the upper stratum, which is partly utilized, and any excess therefrom stored for other use.

VITASCOPE.—F. J. MUKAUTZ, 1650 E. 55th St., Cleveland, Ohio. This apparatus is for use in connection with a phonograph, the ar-

rangement being such that both instruments move in unison, so that persons may be represented upon a screen in an act or in conversation, the words for the lines which the actors are supposed to say being supplied by the phonograph at the appropriate time.

MACHINE FOR TESTING MATERIALS.—H. Schiller, manager, 150 Engerthstrasse, Vienna, XX/2, Austria. The object of this inventor is to provide a press of such a shape and arrangement of its parts that not only annular or tubular work-pieces, but also rod-shaped trial-pieces can be tested, both as to tensile strength and also as to resistance to collapse or buckling resistance.

SCREENING DEVICE.—O. R. Smith, care of J. F. Carson, Box 141, Mullan, Idaho. This device relates to a new and improved screening mechanism used in the separation of different sized materials, and may be used at any place where it is desired to separate materials, as, for instance, grain, seed, ores, sand, different sized materials, etc.

Prime Movers and Their Accessories.

GASOLENE SPRAY OR VAPORIZER VALVE.—Quincy Engine Company, Quincy, Pa. The object of this improvement is to provide a device especially adapted to automatically regulate the fuel charge for explosion engines, both as regards the amount and relative proportion of ingredients of the mixture in accordance with the conditions to be met.

Railways and Their Accessories.

AUTOMATIC COUPLING DEVICE.—F. J. Fitch and G. Bausback, Center and Market Sts., Pottsville, Pa. An object here is to provide a device which will automatically connect the main train pipe section, the steam pipes for heating the cars, and air pipe for signalling purposes and electric circuits for lighting or signaling. A further object is to provide a coupling head having a removable head in which the gaskets are disposed, thereby facilitating removal and replacements of the gaskets.

Pertaining to Recreation.

PUZZLE TOY.—A. L. Pooler, 24 Hammond St., Bangor, Maine. This invention comprehends a movable figure causing amusement because of the fantastic position it assumes, and as a puzzle the device constitutes a means of exciting great curiosity in attempting to change the figure from one extreme position to another.

Pertaining to Vehicles.

VEHICLE WHEEL.—J. W. McCallum, Plymouth, Ind. This wheel is adapted to be assembled and bound together to form a continuous wheel from segments adapted to be assembled and bound together to form a continuous wheel; the segments are formed so that the members thereof are integrally related; and the maximum rigidity is obtained with a minimum weight.

LIGHTING SYSTEM FOR VEHICLES.—L. R. Duval, 558 Clinton Ave., Union Hill, N. J. This invention refers to electric lighting systems for use on motor vehicles, and more particularly to that type of system in which there is employed a dynamo driven from the engine for generating the necessary current for the side and tail lights and the search-lights.

Designs.

DESIGN FOR A SETTING FOR GEMS.—H. Ackerman, Weehawken, N. J. The shape of the base is circular, and the edge comprises six ornamental formations. The side elevation of the design is flaring and slants down toward the base.

DESIGN FOR A LAMP SHADE.—J. Fairburn, Manhattan, N. Y., N. Y. This ornamental design for a lamp shade has the characteristic of extreme simplicity of form which nevertheless secures a very graceful result, both in plan presentation and side elevation view.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We are prepared to render opinions as to validity or infringement of patents, or with regard to conflicts arising in trade-mark and unfair competition matters.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

Munn & Co.,
Patent Attorneys,
361 Broadway,
New York, N. Y.

Branch Office:
625 F Street, N. W.,
Washington, D. C.

Sulphur at Home and Abroad

(Concluded from page 139.)

tion of sulphur in all the United States had not reached as high as 5,000 standard tons per annum, but due to the opening up of the Louisiana deposit, the figure jumped to 127,000 tons in 1904, and 360,444 tons in 1908. Since that year it has fluctuated around 250,000 tons, and last year totaled 265,664 tons. The yearly production of the Japanese mines averages about 40,000 tons, which is marketed principally in Australia.

The American sulphur interests were, prior to the outbreak of the war with Turkey, credited by the Italians with having obtained control of the sulphur fields of Cyrenaica—fields that extend along the desolate shore of the Gulf of Sidra, which the Arabs call Giun-el-Kebrit, or the "gulf of sulphur," just as they call the immediate region of the sulphur deposits Gebel-el-Kebrit, or the "zone of sulphur."

The alarm of the Italians arose from the landing in Cyrenaica from the private yacht of Allison V. Armour, a little less than two years ago, of a scientific expedition sent thither by the Archeological Institute of America, and headed by Prof. Richard Norton, of Harvard University. The purpose of this expedition was to excavate the ruins of the ancient city of Cyrene, the site of which is more than two hundred miles eastward of the sulphur territory.

A rumor that the Turkish Government had granted a concession to Americans for the exploitation of the Cyrenaica deposits was so far credited in Sicily as to be made the subject of an interpellative protest in the Italian parliament in February, 1911, by Deputy Vaccaro, of the Sicilian province of Girgenti, where the world's oldest sulphur operations mainly center.

It was pointed out by the southern deputy that "such a concession would fatally compromise the Sicilian industry," which, he asserted, could absolutely not resist the competition of an American company exploiting the Cyrenaica field.

In the month following the deputy's query, news came from Cyrene that Herbert Fletcher de Cou, of Michigan, one of the members of the American archeological expedition, had been slain by a hired trio of Arab assassins. The official report of the murder, as made to the Archeological Institute of America by Prof. Norton, contained the significant statement that "the Italians had spread false reports about my intentions; . . . that our true purpose was not to dig the ruins, but to mine for sulphur."

It is a favorite theory of Italian geologists that the island of Sicily, instead of being a detached part of the continent of Europe, in a prehistoric age formed the northernmost part of Africa. Those who hold to this belief regard the rich and abundant sulphur deposits of Sicily as the logical conclusion of a virgin stratification that must have its origin in the low mountain range that forms the plateau of Aurigi, to southward of the coastal plain of Cyrenaica. On this coastal plain, in the region of Gebel-el-Kebrit, the evidences of sulphur wealth have revealed themselves to modern science, not as a compact and well-defined area, such as Sicily's, but as a straggling drift, emanating from what, farther inland, must prove to be an exceedingly bountiful store of the mineral. However, it is only that part of the coast territory of Cyrenaica lying within a few days' journey by horseback from the sea that has been explored by Europeans competent to judge of sulphur productivity.

An authority recently delegated by the Italian Government to investigate and report upon the sulphur prospects of Cyrenaica was Dr. Salvatore Giannò, who visited the country in the capacity of commercial *attaché* of the Italian legation at Constantinople. Writing in the *Rivista Coloniale*, organ of the Italian Colonial Institute, Dr. Giannò lately observed:

It appears evident that the sulphur zone in Cyrenaica describes an angle from Muktar, Oasis of Abu-Naim, Hara-Dedba, ...

ing a line of resistance to the rich mineral drift of the Sicilian coast, which, starting from the base of Mount Etna, follows the mountainous chain to Lecara, and thence to the mountains of Gibellina. . . . The sulphurous stratum, therefore, in Cyrenaica, lacking a scientific exploration in the true sense of the word, may not, indeed, must not, be restricted to the known deposits, or to those caves, or quarries, exploited crudely and in embryo by the Arabs, but must be found to follow the mountainous line that stretches from Ara dei *Fileni* to confine the Plain of Barca.

That low chain of mountains which extends from Sebka-Muktar to Gebel-el-Ala, to Gebel-dj-Djeria, to Frerin, to Maradek, to Marsa-Braiga, and so to Hara-Docha, is a vast deposit of sulphur, part explored, but the greater part unexplored. From ancient times the inhabitants of the region have been given to a superficial working of the deposits, not for the uses wherefor sulphur is most in demand by the market, but for that, infinitely more modest, of doctoring camels afflicted with the mange, and the outlet on the sea, or gulf, for the product, is always the port of Marsa Braiga, whence the sulphur is dispatched by sailing vessels to the caravan ports—Tripoli, Benghazi, Alexandria.

To the south of Marsa-Braiga, a small natural port on the Gulf of the Great Sidra, there is a quarry already in operation. It is called Kofra-el-Kebrit (Cave of Sulphur) and from this the Arabs extract the product. This quarry is distant about twelve hours from the shore. Another deposit, which I believe to be the richer, is found to the southwest of Gebel-dj-Djeria. This follows the little mountainous chain extending from Muktar to Hara-Docha, and the stratum is so ample that it is to be traced in four days' journey by horse in the direction of the meridian. The quality of this sulphur is of the best, and the mineral, without being attached to the rock, presents itself in a purer state, and in greater quantity as depth is attained.

The richness of the mineral, from examinations made on the field of the quarries in operation, needs not to be discussed; from experiments made it yields an *ottavo* of purity . . . The primitive and superficial operations of the Arabs in the aforesaid quarries indicate that the mineral they obtain is that which is found in the first stratum—exposed, as it were, at but a few meters of depth; while at the second stratum there is always observed a sure improvement in the quality of the mineral, and at the third stratum it betters in exact ratio to the depth attained. Where thick, the sulphur is found to be richer than where it is submerged in water.

Sugar Beet Industry of Germany

(Concluded from page 134.)

The thinning of the beets as well as their cultivation is a work to which (according to the German idea) women are especially adapted. Their wages as field hands are only about 60 per cent that of men, although in this kind of work they do about as much. The extension of sugar beet growing in Germany quickly brought about a shortage of labor and caused the introduction of what is known as the "season workers" or immigrant laborers, who are brought in to work during the beet season, and at the close of it are sent back to where they came from. Every spring hundreds of thousands, in recent years over 400,000 men and women, come from the eastern provinces of Germany, from Russia, Hungary and Bohemia, to the central and western provinces of Germany to work, principally in the sugar beet fields.

So important has this large movement of foreign laborers become that legislation has been passed specifying the time (15th of November for central Germany) by which they must all be returned.

The large property owners have made special provisions for caring for this foreign labor by erecting barracks for them to live in. In addition to a cash wage, an allowance is given in provisions such as potatoes, meat and flour. The beet growers prefer to get as large a proportion of women as they can, and as a consequence many more women than men are to be seen working in the German beet fields.

The influx of such large numbers of foreign workers onto the farms during the summer months naturally has a detrimental effect, both socially and morally, and while it has solved the problem of furnishing the necessary help during the summer months, it has resulted in driving out the native farm laborers, who have been unwilling to compete with the season workers, and they have gone into other industries or moved away, so that during the remainder of

the year there is a scarcity of farm labor.

To an American it is repugnant to see thirty or forty women working in a beet field under a man boss, but when he raises any question as to the fitness of it, he is quickly told that it is better for them than working in American factories in our large cities. Perhaps it is, because for the most part they are young, strong Bohemian and Polish women who seem to have as much physical strength as a man But it is all contrary to the American conception of the sphere of woman, and if sugar beet culture cannot succeed in America without the general adoption of the use of women laborers, it is not likely to make any great progress, and we shall continue to import our sugar.

Germany's Gain in Exporting Sugar.

Germany, with its annual export of 800,000 to 1,000,000 tons of sugar, worth $50,000,000, is gaining not only that volume of international trade, but is not losing a penny's worth of plant food from the soil, because sugar is nothing but sunshine, water and carbon dioxide. On the other hand, the United States imports over $100,000,000 of sugar every year, and exports cereals and cereal products to a value of over $130,000,000. These cereals are all rich in the elements of plant food that come from the soil and determine the degree of fertility of the land. These elements, nitrogen, phosphoric acid and potash, have a stable market value at which they are sold in the form of commercial fertilizers It is a simple matter of calculation to determine what it would cost to replace the plant food that we lose each year through our export of cereals and cereal-products, and estimating these on the most conservative basis it amounts to at least $30,000,000

This certainly is wise economics from the standpoint of German agriculture, and so long as Germany can find a market for its sugar, they can well afford to import the grains, mill-feeds and other concentrates, and thus build up their own agriculture, but from the standpoint of the United States, we cannot afford to go on paying out over $100,000,000 per year for sunshine, water and carbon dioxide manufactured into the form of sugar

Germany's Interest in American Beet Sugar.

Since the beginning of the beet sugar industry in America, Germany has watched its development anxiously Many investigations have been made of it, and as much or more has been published in Germany concerning it as in America. The consensus of opinion here seems to be that the one great obstacle to sugar beet production in America is the labor problem The fact that America does not have the cheap labor of Europe, and especially that women are not used as field laborers, the Germans think is sufficient to keep the United States from becoming any serious competitor But notwithstanding these handicaps, and the fact that the beet sugar industry has only been established in the United States about twenty years, we already produce one fourth as much beet sugar as Germany, and the production is constantly increasing.

The United States uses more sugar than any other nation, and although only two other nations surpass it in the amount produced, Germany and Russia, it is still necessary to import more sugar than any other country in order to supply our needs. Last year the importations amounted to over two million tons, and in addition to this one and one half million tons were produced within our borders, including Hawaii and Porto Rico, approximately one million tons being produced from sugar cane and one half million from sugar beets.

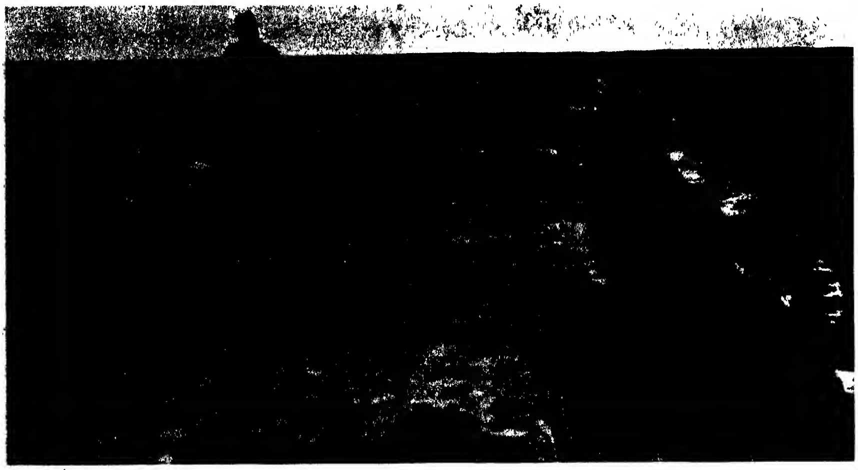
We may increase our sugar production as much as the total production of Germany at the present time, and we will only be producing enough to supply our own consumption. Surely as far as the United States is concerned there is no great danger of lacking a market for all the sugar we may produce.

SIXTY-EIGHTH YEAR

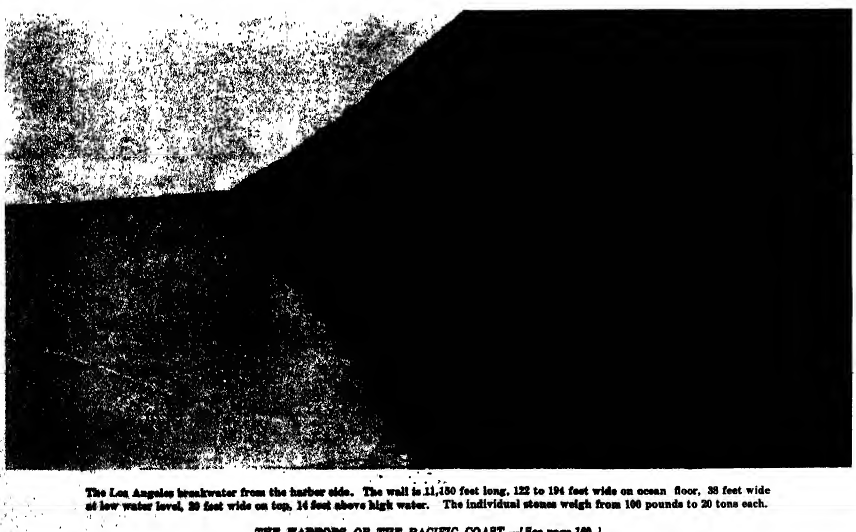
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 8.] NEW YORK, AUGUST 24, 1912 [10 CENTS A COPY $3.00 A YEAR



The sum of $2,900,000 was spent in constructing 9,250 feet of the Los Angeles breakwater. The mass of stone used weighs 2,420,337 tons. The breakwater creates an outer harbor of refuge, 375 acres in extent.



The Los Angeles breakwater from the harbor side. The wall is 11,150 feet long, 122 to 194 feet wide on ocean floor, 38 feet wide at low water level, 20 feet wide on top, 14 feet above high water. The individual stones weigh from 100 pounds to 20 tons each.

THE HARBORS OF THE PACIFIC COAST.—[See page 160.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, AUGUST 24, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid . .	3.75

The Scientific American Publications

Scientific American (established 1845)	per year,	$3.00
Scientific American Supplement (established 1876) .	"	5.00
American Homes and Gardens . . .	"	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Railway Speed and Safety

THE Public Service Commission, after investigating the recent wreck of the Twentieth Century Limited, found that the accident was due to the breaking of a rail, and that, though the rail was a fairly good one, it was not equal to the strain to which it was subjected under the high speed of this famous train. According to the report, the fastest express trains are running on "schedules too fast for safety;" and the commission recommends that the speed should be reduced with a view to easing up the burden which is now imposed upon the tracks. In other words, instead of bringing the rails up to the speed, it is suggested that the speed be brought down to the rails.

Now, this means that the rail manufacturers are to be put in control of the whole situation; they are to manufacture the kind of rail which suits their particular whim, and then the speed is to be adjusted to whatever kind of product they care to turn out. Put in plain words, that is the exact situation; and if ever there was a case of deliberate retrogression, it is to be found in this proposal to reduce speed. We are not for a moment disputing the broad wisdom of the suggestion made by the commission. On the contrary, we believe that the commission is correct in its statement that the present speeds are too high for the kind of rails over which it is being made. Until an absolutely reliable rail is produced, it would certainly be desirable to ease up on the heavy strain to which the present rails are exposed, when the enormous engines which haul our fastest trains run at speeds of from sixty to eighty miles an hour.

In the choice between high speed and good rails, however, it is assuming too much to suppose that it is impossible to produce a rail which will stand up under heavy, high-speed traffic. On the contrary, it is well understood by engineers that it is possible to produce such rails, and that the failure to secure them is entirely due to the rail makers. More than once, the SCIENTIFIC AMERICAN has gone deeply into this question, and we have shown that the deterioration in steel rails is due entirely to the reluctance of the rail mills to discard a sufficient percentage of the steel ingot, and to put into the rolling of the rail in the mills that time, care and patience, which are necessary to secure an absolutely reliable product. When the steel has been cast into an ingot, preparatory to rolling it down into rails, a large percentage of the steel is defective. Conscientious manufacture demands that the whole of this defective portion be cut away, and only the sound portion be sent on for heating and rolling. The engineers of the railroads, anxious to secure rails free from "pipes" (hidden, incipient fractures in the rails) demand a large percentage of "discard" as it is called, asking sometimes for as much as twenty-five per cent; but the manufacturers, aiming at economy of time and labor, a cheap product, and large output, have always contested this demand of the engineers, and have made the discards just as small as they possibly dare to do.

So powerful has been the influence of the manufacturers, many of whom are directly interested in, and more or less control, the railroads, that they have continued to send out an inferior rail, and the result has been shown in the large number of accidents in the past few years, that are attributable to rails which have broken because of incipient pipes or fractures, hidden within the rails.

The Public Service Commission is in favor of high speed under proper conditions; but it begins to look as though it realizes how all-powerful is the influence of the manufacturers, and, therefore, despairing of a sufficiently good rail, the commission has taken the only course open to secure safe travel, and has recommended that speed be reduced.

But high speed, under proper conditions, is one of the ear-marks of progress; and it is too early in the day to acknowledge defeat and accept whatever the manufacturers are pleased to offer. A redesigning of the rail section, a better distribution of the metal in the various parts of the rail—head, web or base—a twenty to twenty-five per cent discard of the ingot, and a showing down of the rail mills to a speed which would insure a high quality in the steel, would give to the country a rail over which fast trains could run at high speed, without danger of derailment.

First Fruits of the "Titanic" Disaster

THE White Star Company, is to be commended for the promptitude with which it is putting into practice the lessons taught by the "Titanic" disaster. According to cable dispatches, the company is making radical changes in the underwater construction of its two largest vessels, the "Gigantic" and the "Olympic." The extensive and costly nature of this work may be judged from the fact that the total expense is given as approximately a million and a half dollars. The outlay is large; but we believe that it will be more than compensated by the increased confidence of the public—a confidence which was rudely shaken by the sudden loss of the latest and finest of the ships that fly the White Star flag. For the past fifty years the White Star ships have been regarded (and very justly so) as among the most substantially constructed and best officered of the trans-Atlantic liners. The recent disaster was chargeable more to the system under which modern ships have been built and operated than to any particular delinquency on the part of the company, whose vessel happened by the laws of chance to be the one selected to demonstrate how faulty that system was.

Therefore, the prompt action of this famous line in taking steps to render its ships proof against such an accident as befell the "Titanic," is certain to restore confidence in the White Star Line and lead the way in a return to those principles of safe construction from which the art of shipbuilding had so widely departed.

The changes in the "Gigantic," a slightly larger vessel than the "Titanic," were foreshadowed by Mr. Ismay in his testimony before the Senate Investigating Committee. The "Gigantic" is now under construction at the Belfast yards, and the improvements will consist in extending the inner plating of the double bottom up the sides of the ship, to a point well above the deep load water line. We are not in possession of the details; but in all probability this plating will be riveted upon the inner flanges of the heavy web frames, nearly three feet in depth, which extend throughout the greater part of the ship's length. In his testimony before the Lord Mersey investigation in London, Mr. Wilding, the chief naval architect of Messrs. Harland & Wolff, stated that there was an objection against such an inner skin, on the ground that it would be difficult to inspect the inner surfaces of the plating, and serious rusting might occur. The objection would be valid if the space between the skins were too narrow to admit a force of painters. But a width of three feet would give the necessary clearance, and it would be quite possible to provide manholes, of suitable size, through which a gang of men could enter to inspect and repaint the interior surfaces.

The changes to be made in the "Olympic" will be even more extensive and costly. They will involve an entire reconstruction of the boiler rooms. The present transverse bunkers will be removed, and new coal bunkers will be built along the sides of the vessel, the construction being similar to that of the "Mauretania" and other ships of her class. This will involve an entire re-arrangement of the boilers, which at present are placed five abreast, each battery extending entirely across the ship. Probably the boilers will now be placed three abreast, which would leave sufficient room for longitudinal coal bunkers. The inner walls of the bunkers will form practically an inner skin to the ship, and any rupture of the outer skin would involve the flooding of merely the relatively small bunker compartments in the neighborhood of the injury.

The fact that this work has been undertaken by the White Star Company in advance of any legislation making it mandatory, is very significant; and it cannot fail to exert a powerful influence in hastening the forthcoming reforms in the construction of passenger ships. If the changes in the "Olympic" and the "Gigantic" are to be made in association with a watertight steel deck, at or near the water line, it is not too much to say that the fine vessels will be practically unsinkable by any conceivable disaster of the sea.

The Unfortunate Bureau of Chemistry

IF any one who is at all familiar with the present organization of the Bureau of Chemistry and its unscientific methods cherished the illusion that a new and brighter era was to dawn with the appointment of an energetic, competent man to fill Dr. Wiley's place, and that the investigations of the bureau were henceforth to be so conducted that it would be unnecessary to maintain at great expense a Referee Board to check up the work of the Bureau, he is doomed to disappointment.

The Pure Food and Drugs Act, as fine a piece of legislation as Congress ever enacted, is destined to remain ineffective because the head of the Bureau of Chemistry is either unable or unwilling to gather scientific evidence of frauds and to present that evidence in legal form. It is highly probable that the real scientists in the bureau, the men who have conscientiously endeavored by rigorously conducted experiments to ascertain the actual and not the supposed effects of drugs and preservatives in foods and beverages, will resign, leaving behind them a heterogenous collection of alleged analysts and of pseudo-chemists. Not until incompetent officials now in positions of authority have been relegated to places which they are really able to fill, and are prevented from further interfering with the effective administration of the Pure Food and Drugs Act will the Bureau of Chemistry be in a fair way of redeeming its shattered scientific reputation. It is astonishing to us that the press throughout the country has failed to realize how farcical it is to have a Bureau of Chemistry and a Referee Board engaged in exactly the same work, the one vehemently proclaiming its guardianship of the public stomach, the other critically examining the facts by the rigorous methods of scientific reasoning and experiment. In no other branch of the Government service, certainly in no branch in which scientific work is conducted, is this anomaly to be found. The Bureau of Chemistry has the unenviable distinction of requiring supervision from an extraneous body of experts. Like the sophomore class at college, it needs the correction of a faculty; and, as might be expected, conducts itself in a sophomoric way.

The situation must be intolerable to every man of real scientific instincts. Men who have conscientiously endeavored to ascertain whether or not certain ingredients in foods and drugs sold to the public are harmful or not, and who have been bold enough to voice their convictions in reports recommending that manufacturers be permitted to use these ingredients because of their harmless effect, have been treated as rascals. Men with little or no laboratory experience, who have prepared what may be called cooked-up evidence of fraud and toxicity have been praised and advanced, even though the courts have ultimately decided against them.

The daily press has hailed with enthusiasm the appointment as head of the Bureau of Chemistry of a man whose past career holds out no promise for future reform in the methods of administering the Pure Food and Drugs Act. A graduate of an agricultural college in the Middle West, he has never published any scientific work of importance; nor has he pursued any graduate studies. The relation of physiology to the Pure Food Law is a sealed book to him. Far better would it have been if an intelligent civilian with an open mind were appointed.

Alas, for the Pure Food Law! Manufacturers who have money enough to fight in the courts and to engage experts at high market prices will continue to toy with it, and the poor public will continue to alleviate the pains of indigestion, contracted because of the Bureau's ineptitude, with medicines whose sale the Bureau ought to prevent. If "muck-raking" were still journalistically fashionable what a sensation the exposure of the conditions in the Bureau of Chemistry would create!

The International Institute of Agriculture.—M. Louis Dop, the French delegate to the International Institute of Agriculture in Rome, and vice-president of the Institute, has published a pamphlet reviewing the history of this remarkable body, and predicting the lines of its future development. Fifty countries now adhere to the convention of 1905, and contribute a total of $100,000 a year to the maintenance of the Institute; while the King of Italy, from his private means, contributes $60,000, and has given the Institute a splendid building in Rome. Besides the world-wide crop-reporting service—which has been the dominant feature of the enterprise from the beginning—many other lines of work are carried out on a vast scale. Probably one of the most important is the collection and abstracting of agricultural literature from every corner of the world. The voluminous publications issued by the Institute during the last two or three years include, besides its regular periodicals, many exhaustive reports on special subjects, e. g., the crop-reporting systems of the different countries, the organization of agricultural meteorology, statistics of hail insurance, etc., etc.

Electricity

Tungsten Street Lamps in Chicago.—Chicago has decided to substitute 80-watt Tungsten lamps for the gas street lamps it now uses. The gas lamp posts are being remodeled to receive the electric lamp. Over five thousand Tungsten lamps are to be installed.

An Automatic Waiter.—An Australian has invented an electric waiter for hotels and restaurants, operated by the customer seated at his table. A wooden frame holding the menu card is fitted with push buttons opposite each item, and "pressing the button" rings a bell in the kitchen and displays the order and the table number. The kitchen apparatus also prints a check the original of which comes to the customer, with a duplicate on an endless tape. This device has been in successful use in New Zealand.

Vacuum Cleaning Extraordinary.—A machine combining two modern inventions, the electric car and the vacuum cleaning apparatus, has been applied in Strassburg to clean the tramway tracks of that city. In the operation of the machine the roadbed is sprayed with water, then the dirt is loosened by a scratcher and drawn up into the car by the suction apparatus. With this machine one man can clean 25 miles of track a day, replacing the labor of 17 men working in the ordinary way.

Electrical Transmission of Small Water Powers.—The present day is one of very large hydro-electric transmission schemes, but in France small water powers have been successfully utilized. A typical rural hydro-electric scheme is that of Cotentin, on the banks of the river Saire. In this installation the energy in the fall, only 15 to 20 horse-power, is transmitted over a maximum distance of 4½ miles. During the day the output of the generating plant is utilized to run dairy machinery, and at night the current is switched on to lighting circuits.

Flashing Sign for Autotruck.—The large number of electrically propelled trucks now in use has suggested the idea of equipping these trucks with electric flashing signs. This has been tried out and has proved very effective. An automatic flasher is used which will change the color of the sign with each flash. The name or trade-mark is outlined with electric lamps and the sign is flashed out at frequent intervals in red, pink, white and green lights. The effect is very pleasing making the advertisement correspondingly valuable.

Improved Method of Lifting Pig Iron with a Magnet.—It is quite a common practice to use lifting magnets for handling furnace pig iron. Usually the pigs are stacked horizontally and not many of them can be lifted at a time because a relatively small number can be brought into contact with the magnet. Someone has recently hit upon the idea of stacking the pigs vertically, so that the face of the magnet will touch a greater number of pigs. It has been found that by this method, the lifting capacity of a magnet which heretofore was able to raise only 1,000 pounds of pig iron was increased to 2,000 pounds.

Reflecting Power of Wall Papers.—The surface brightness of walls or ceilings lighted by daylight or artificial light is now determined directly by an improved portable apparatus for measuring illumination and known as the "holophane lumeter." Tests of various wall papers in rooms lit by tungsten lamps showed that a surface brightness of 0.3 foot-candles is usually necessary to give the room a cheerful appearance. Light blue, dark red, deep green, and very deep blue wall papers showed surface brightness varying from 0.3 foot-candles for the first mentioned to 0.05 foot-candles for the last mentioned, with corresponding reflecting powers varying from 40 per cent to 4.5 per cent.

Short-haul Electric Truck Service.—An excellent illustration of the value of the electric truck for short haul is cited by the *Electrical Review and Western Electrician*. In a certain large mill a boiler plant is located about a hundred yards from the coal storage yard. The fuel used to be handled by wheelbarrows, but an electric truck salesman learning of this work, made an investigation of its cost and came to the conclusion it could be done more economically by the use of a motor-driven truck. A storage battery truck was purchased and it soon proved its economy. A single man was required to operate the truck, his work including the loading as well as the discharge of the truck.

Hand-driven Generator for Wireless Telegraphy.—The United States Signal Corps has developed a new form of generator for use with its portable wireless telegraph sets. It consists of a small generator, the rotor of which is driven by hand cranks through a suitable gearing. Two cranks are provided, so that two men may drive the motor at the same time, and if necessary four men may be employed—two at each handle. A low and high speed release is provided, which disengage the driving gear when the speed rises above or falls below a predetermined limit, so that the rotor may be kept at a fairly constant speed. The generator is capable of turning out about 200 watts, and it is light enough to be packed on a mule. The portable generating set has a sending capacity of about fifteen miles.

Science

Cape Deshnef.—The extreme northeastern corner of Asia is still called "East Cape" in many atlases and other geographical works. The *Bulletin* of the American Geographical Society calls attention to the fact that the name of this point was changed to "Cape Deshnef" in 1898 by command of the Emperor of Russia, in honor of the explorer who discovered it.

Surveying with the Camera.—The first extensive use of the panoramic camera to supplement the plane-table in surveying is said to have been that made by Mr. J. W. Bagley, of the U. S. Geological Survey, in mapping an area of 160 square miles around Valdez, Alaska, during the season of 1911. This method promises to become a regular feature of the Survey's work in Alaska.

The Twelfth International Congress of Geologists met at Toronto, Canada this week. Among the special subjects for discussion were the world's coal supply, and interglacial periods. Twelve excursions of from one to twelve days took place before the meeting, and ten of from four to twenty-three days after it; some of the latter extending to the Pacific Ocean and the Klondike.

Fixing Atmospheric Nitrogen in Iceland.—Thorlakhavn, the best natural harbor on the south coast of Iceland, has been acquired by a French company, along with neighboring waterfalls yielding about 200,000 horse-power, and a plant will be erected at this place for manufacturing artificial saltpeter by the utilization of atmospheric nitrogen, according to the Birkeland-Eyde process.

Numbering Street Car Lines.—The names of street car lines are usually a source of perplexity to new arrivals in a city, and the confusion is often increased rather than mitigated by the signs on the cars. A consular report from Amsterdam tells us that in that city the convenient plan has been adopted of giving each car line a number. This number is suspended between the arms of the trolley pole on each car and is visible several hundred yards away. The numbers are always referred to in directing inquirers. Most German cities have a similar system, which works very successfully.

A Rhine Museum is soon to be founded at Koblenz, if present plans are carried out. It will include a large collection of charts, pictures, models and diagrams illustrating the physical conditions, past and present, of the famous river, and a complete exposition of its economic history. Some of the unique features will be: Models of the various types of vessel used on the Rhine from early times to the present; models of past and present bridges; illustrations of the methods and apparatus used in maintaining and improving the navigability of the river. A fine series of geological models is contemplated. The city of Koblenz has already given a site for the building.

Spitsbergen as a Scientific Preserve.—Diplomatic negotiations regarding Spitzbergen, now in progress, contemplate the unique plan of setting aside this far northern archipelago as a sort of happy hunting ground for scientific men. According to this plan, no land can hereafter be acquired in Spitzbergen except for purely scientific or humanitarian purposes, and the further exploitation of land already in the possession of commercial organizations (mines, fisheries, etc.) will be placed under such restrictions as will ensure the preservation of the flora and fauna. The hunting of fox, polar bear, walrus and reindeer will be prohibited from May 1st to September 15th. The hunting of elder-duck will be prohibited entirely, as also the use of poisons and explosives in fishing.

The Pittsburgh Smoke Investigation.—The Department of Industrial Research at the University of Pittsburgh has published the first of a series of bulletins on the investigation of the "smoke nuisance," for which funds were provided on a munificent scale by a Pittsburgh business man. The investigation is being carried on by a staff of twenty-five specialists, six of whom give their entire time to the work, while the others have been intrusted with the preparation of reports on special phases of the subject. The topics discussed briefly in the initial bulletin are: Smoke and the Weather; How is Vegetation Affected by Smoke and Soot; The Chemistry of Smoke and Soot; The Physical Problems of Smoke; Deterioration of Buildings and Building Materials; Smoke and Disease; What the Smoke Nuisance Costs; Who Makes the Smoke; Laws and Ordinances Concerning Smoke; General Experimental Work; Smoke Means Waste and Inefficiency; The Education of the Public; The Question of Legal Regulation. It is stated that the smoke nuisance costs Cleveland $6,000,000, Cincinnati $8,000,000, and Chicago $50,000,000 a year, and the whole country over $500,000,000 a year, in damage done to merchandise, defacement of buildings, tarnishing of metals, injury to human and plant life, increased cost of housekeeping, and losses to manufacturers due to imperfect combustion of coal.

Automobiles

$80,000,000 Invested in Electric Vehicles.—According to statistics collected by T. C. Martin, chairman of the committee on progress to the National Electric Light Convention at Seattle, recently, there are at present invested no less than $80,000,000 in electric vehicles, of which sum about $25,000,000 represents the outlay for trucks and delivery vehicles, and $55,000,000 the value of pleasure cars.

Huge Racing Car Coming.—A specially built, 300 horse-power Benz racing car soon will make its appearance in America. The car is said to have been purchased by a well-known race promoter and will probably be driven by Robert Burman, holder of the world's record for straight-away speeding, in an endeavor to lower his own record of 25 seconds for the mile. The car is reported to have made a mile in 21 seconds, or almost three miles a minute.

Yellowstone Park and Automobiles.—Representative Rucker has petitioned the United States Government to open Yellowstone Park to automobiles. This famous park is still closed to motorists, and it is claimed that there is no valid reason why it should remain so. The present-day automobile is a different thing from the unreliable noisy contraption which was excluded from the park years ago. There appears to be a growing disposition on the part of those responsible to open the park to tourists and their motor cars.

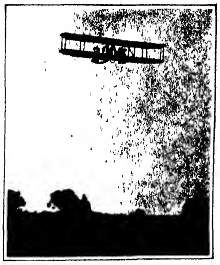
Motorist Poisons Fish by Carbide.—An American tourist had a peculiar experience recently in Southern Bavaria. Passing by a small stream, after a long trip, he stopped his car to empty the old carbide from his acetylene generator and refill it. A few days later he received a note from the supervisor of the county, notifying him of a suit for damages entered against him for poisoning the fish in the river with carbide. It seems that the part of the river had just been stocked with bass, and many had been killed by the gases developed by the carbide residue.

London Introduces "Reversible Omnibus."—Because of the narrow streets in several parts of the city of London it has been found impossible to use the ordinary motor omnibus on account of its comparative length and the attending difficulties of turning the bus around at the end of a trip. Some of the routes laid out for the motor buses are circular, thereby obviating the necessity for making complete turns. On some occasions it has been found impossible to map out circular routes, and a new type of bus is being tried out, which is reversible, the same as a trolley car. It can be steered from either end, conductor and driver simply changing places.

University Establishes Automobile Science Course.—The first university in this country to recognize the importance of the motor car and to place it on an equal footing with the building of bridges, railroads and tunnels, with chemistry and other sciences, is the University of Southern California. The new course is for the benefit of automobile mechanics, engineers and designers, and the first professor of automobile science is Stanley Smith, C.E., who has just been appointed to the chair. While he will deliver lectures on the various subjects properly belonging to automobile science, he will specialize on motors and their efficiency, sliding, poppet and rotary valve types, etc.

Military Exemption for French Motorists.—For the purpose of facilitating the transportation of the general staff in case of war, the French military authorities have decided to give those who own cars of medium horse-power, and who are able to prove their ability of driving them and taking care of them as far as tires and ordinary road repairs are concerned, a special opportunity to discharge their military duties in an agreeable manner. Instead of being compelled to drill with the other conscripts, such owners must sign an agreement with the authorities that they will turn over to the government immediately following mobilization the vehicles described in their application for this sort of service. At all maneuvers the car must be at the service of the military authorities, to be driven by the owner himself under orders from the officers.

Mysterious Fire from Odd Cause.—A German motorist the other day discovered the most extraordinary cause of a fire starting in the carbureter of his automobile that has ever been brought to public notice. Noticing a leak in his carbureter connections, he stopped the car in a completely deserted road in full sunlight. There was no spark, fire, match, broken insulation, or any other thing that could possibly have caused the gasoline to catch fire; yet in a few moments the carbureter was ablaze. Luckily the motorist was something of a scientist and he started on an investigation of the "why and wherefore"—after he had managed to extinguish the fire. To his surprise he discovered that the catch on the convex front lens of the headlight had become unfastened and the lens had swung around in such a manner that the sun's rays became focused directly on the leaky connection at the carbureter; a highly effective burning glass being thus responsible for the "inexplicable" blaze.



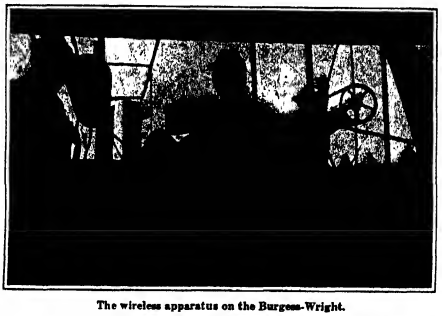
The Burgess-Wright off on a reconnaissance.

The Aeroplane in the Military Maneuvers

The War Operations in Connecticut Clearly Point to the Necessity of Having a Large Well Trained Corps of Aerial Scouts in Our Army, Equipped With Machines Capable of Rising from Unfavorable Ground With Two or More Occupants

Lieuts. Milling and Foulois in the Curtiss machine.

NO doubt the most important feature of the mimic war in the hills of Connecticut has been the scouting of the aviation squadron. This is the first time that aeroplanes have played an important part in any military maneuvers in this country, and their work has been exceedingly gratifying. After the region in which it was decided to hold the maneuver had been selected, it was gone over very carefully to find a suitable field from which the movements of the troops could be directed and where the aeroplane squadron could have its headquarters. In this entire territory of 240 square miles, only one spot was found where there was a stretch of three hundred yards practically level and untimbered. Here the headquarters was established and the field was prepared to permit of launching aeroplanes. The engineering corps worked for a day dynamiting the rocks and succeeded in clearing one hundred and fifty yards near the southern end of the field. To the south of the field was a heavily wooded tract, while the north end was closed by a low stone wall. The field was so narrow that the aviators were compelled to start always toward the north regardless of the direction of the wind. This made it particularly difficult because the prevailing winds were at the back of the aviators. Owing to these conditions it was next to impossible to launch a machine with two passengers. In the aviation squad, there were two machines belonging to the regulars and one machine of the New York National Guards. The latter was a Curtiss machine, piloted by Private B. Havens. It was equipped with a 75 horse-power engine, but its wing spread was not great enough to permit of launching the aeroplane under the unfavorable conditions with a passenger. Consequently, the pilot had to go aloft alone and make his own observations. Not being a trained scout, he found great difficulty in observing the armies, and could not distinguish between the various bodies. The Curtiss machine of the United States Army was piloted by First Lieut. T. DeW. Milling of the Fifteenth Cavalry. This machine was also found to have too small a wing spread to lift two men off the ground from the field at Paradise Green. The attempt was made at one time and it came very near to resulting disastrously. With Lieut. Milling was the lightest member of the aviation squad, Lieut. Geiger. The wind behind the aeroplane drove the machine along so rapidly that it reached the end of the field before it could lift itself more than a few feet off the ground. Both occupants of the machine thought that they were doomed, but they succeeded in just clearing the three-foot stone wall by a few inches. They also narrowly escaped collision with the woods at the end of the next field. So narrow was their escape that it was decided to make no further attempt at carrying a passenger until wing extensions could be secured.



The wireless apparatus on the Burgess-Wright.
Note the telegraph key at the extreme right of the picture.

Curtiss aeroplane clearing the stone-wall

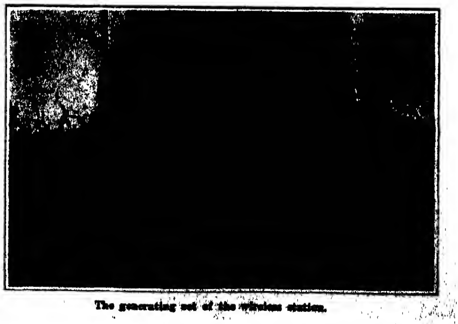
The other regular army machine is a Burgess-Wright. Although furnished with an engine of but 50 horse-power, and capable of making but forty miles per hour, this machine had no difficulty in rising from the field. But Pilot Lieut. B. D. Foulois had equipped it with a wireless telegraph apparatus, the weight and disposition of which made it impossible to carry a passenger. Two other machines which were to have been on hand for the maneuvers were injured on their way to the field. One of these, a hydro-aeroplane, was wrecked in Plymouth Harbor. This was very unfortunate because there would have been a good opportunity to launch a machine from any desired point on the Housatonic River against the wind, regardless of the direction in which it was blowing, and with a passenger, the observations made would undoubtedly have been much more complete than was possible with the pilot flying alone.

During the first half of the maneuvers the aeroplane squadron was neutral, and was required to report the position and movements of troops on both sides. A problem would be assigned to the aviation squadron requiring it to make a reconnaissance as soon after dawn on the next day as practicable, covering a fixed territory usually a triangle, the points of which were given. The instructions were made somewhat ambiguous, so as to test the intelligence of the men. For instance, on August 12th the order was given that "the triangle, Stratford, Derby, and Long Hill, be examined for the location, composition, and strength of the military forces covered therein, results being reported at headquarters, as soon as practicable." On up to midnight the squadron pored over the map, studying carefully the territory and trying to make mental pictures of it. It was found that there were two Long Hills, but one of them was eliminated, because it lay practically in a line with the other two points. It was assumed, therefore, that the other Long Hill must be the one referred to, even though it was not so prominent on the map. Their reasoning proved correct.

The aviation regulations required that they carry registering barographs and wrist aneroids. They were required to fly

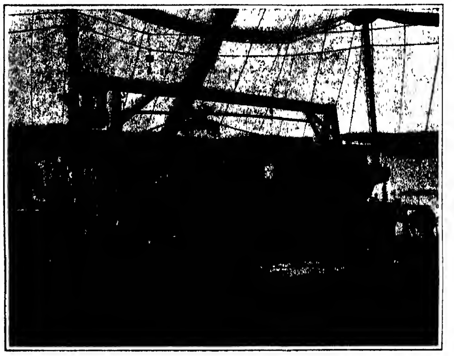
(Continued on page [illegible].)

The wireless station at headquarters.



The generating set of the wireless station.

A view of several of the sections within the tent.



Demonstration of the electrically operated hay unloader.

Teaching the Farmer How to Use Electricity

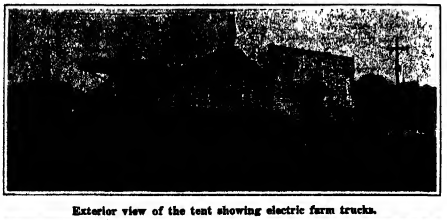
A Circus Tent Display of Farm Apparatus by a Central Station Company

By Thomas Commerford Martin

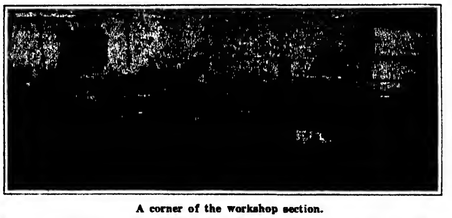
FOR some years past the machinists and electrical manufacturers of the country have been going through an elaborate process of adapting the machine tool and the electric motor to each other, whether for belt or for direct drive; and the development in this important field of industry may at last be regarded as fairly complete; for there is literally no art into which electric power has not now made its way. Indeed, in many branches of production it is already the leading source of energy. This chapter of electrical history succeeded that of the trolley, which in turn devolved from the electric lighting period; and the results of all these epochs are to-day converging upon the efforts that electricity is making to win for itself one of the oldest domains of human endeavor—agriculture. Thanks to the ever-progressive policy of this journal, the readers of the SCIENTIFIC AMERICAN have been made aware of the remarkable advances effected lately in rural districts by electric light, heat, power, and traction, and will also have noted that after all the work has but barely begun, leaving still an infinite opportunity for the engineer, the inventor and the farmer. It is certainly significant of coming changes that this year the subject has been formally presented to the United States Department of Agriculture for study; that the United States Bureau of the Census is seriously considering making it a special part of the electrical census of 1912; and that both the American Institute of Electrical Engineers and the National Electric Light Association are making it the topic of frequent papers and committee reports.

All this new interest, stimulated of course by the high cost of living, the "back to the farm" sentiment, and the greater wealth of rural communities, has been due largely to the fact that the new power transmission systems, looking for a market for their current, are themselves unavoidably throwing a network of circuits over vast agricultural regions, so that in reality the market sought lies immediately around them. Relatively few farmers can afford to put in generating plants of their own, but when the aerial tracks for lighting supply run right by their doors, it is easy and cheap to tap them for even a very small local consumption. This is what is now going on over large areas particularly in the West and on the Pacific Coast, but there is another extremely interesting aspect of the matter to which the present article draws attention. The city central station systems once limited to small urban districts have expanded into the outlying regions to such a degree that where they formerly served but a few square miles of territory they now embrace hundreds. Thus the North Shore lines forming an outer ring to the Chicago system with which they are "tied in," are already supplying electricity in a region of 1,200 square miles with seventy-one towns and villages, and the old Boston Edison Company, not long ago centered tightly around the famous Tea Wharf, operates actively in a principality not far short of 700 square miles. This district, while very populous, is also decidedly rural, with heaven alone knows how many farms and market gardens in it, and hence we find the company, in a highly original way, making a strong play for the farmer's patronage. Within Boston it has been spending over $100,000 a year in publicity to exploit the electric vehicle, and now with protean versatility, it is spending probably an equal sum in trying to electrify the countryside. Such enterprise and ingenuity as are being displayed would seem likely to enjoy a rich reward; at any rate it is only in this manner that the thing can be given a real test.

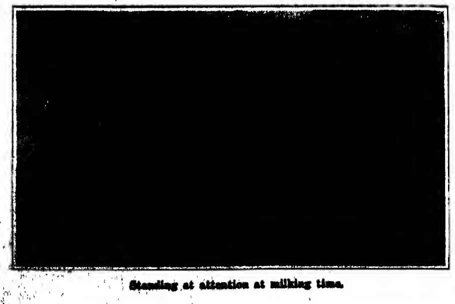
One of the great problems, of course, in introducing



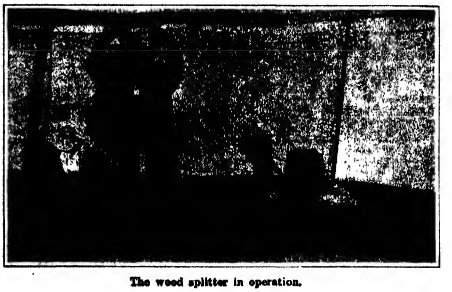
Exterior view of the tent showing electric farm trucks.



A corner of the workshop section.



Standing at attention at milking time.



The wood splitter in operation.

electrical farm apparatus is that of reaching the prospective customer, rather remote from factories and stores and hard to convince by even the cleverest advertising and literature The "prospect" has got to be shown that it is to his benefit to adopt the innovation, and even then will be loathe to invest. In one or two sections of the country the electric power company has aimed to meet the question by buying a farm in the heart of a likely district and operating it on an electrical basis, so that the neighboring folk can see for themselves how it works out. This is a slow method, and, besides, very often a farmer does not want, or need, to electrify his whole farm, but prefers to get some special appliance of a particular make. The plan of the Boston Edison Company has, therefore, been to invade its rural territories with a live demonstration, and to move the show from place to place, so that the whole population within the belt—say 750,000 people—can be convinced, the old farmers converted, and lots of citizens hungry for farm life shown that it is feasible for them, shorn of its wonted drudgery.

It is thus a traveling circus that the company has in operation, and the novelty of that feature alone helps to attract visitors The number of practically interested people inspecting it has averaged about 100 a day right along, to say nothing of any number of persons and children lured by mere curiosity; but even they are not to be despised With an occasional band of music and the regular pink lemonade concomitants, the "Circus Farm," when in full operation is a fair rival of the sawdust ring as an amusement, altogether aside from the fact that it is giving instruction, and has already set the wits working of many a shrewd and inventive observer, who sees at once that here are new ideas and phenomena in the shaping of which he may play a part, as applied to the greatest and oldest industries The Circus Farm is a big canvas tent, 60 by 100 feet, under which is housed a grouping of some forty large pieces of apparatus and farming tools, supplemented by thirty or forty ordinary and smaller appliances. All the apparatus is ready for use, and runs, and demonstrates its economic service on the farm. Each appliance is plainly marked with its name, the manufacturer, its price, and the cost of operation. The price is retail and includes the machine, its motor and everything ready for actual service on the farm. Some machines and tools have been omitted from the exhibition because they have been regarded as unpracticable—at least for use in New England territory. Others are not shown because it has not been possible to "standardise" them, that is, furnish them to the purchaser with "everything all on" ready for operation.

For the first five weeks the farm was located on the Old Middlesex South Fair Grounds in suburban South Framingham, easily reached by the electric car lines The main poles of the tent are surmounted with pennants, and in front of the main entrance have been placed three large canvas display signs in striking colors to add some of the "drawing" effect of a high-class circus. The scheme has proved effective. A broad, main passageway extends down the center of the tent from end to end On either side are the working exhibits protected from the visiting throng by railings. The tent is brilliantly lighted at night with 500 watt incandescent lamps, and the outside grounds are made brilliant with luminous arcs.

Two electric trucks, one of two-ton capacity and another of 700-pound capacity, are used in connection with the farm for hauling material to and fro. A special feature of the truck service has been in demonstrations to the neighboring farmers. Wherever the farmers have shown an interest in the truck proposition, the vehicle suited to the service has been sent out to haul loads around on the farm. From time to time material has been carried from farms into town, or *vice versa* The result has been that many of the farmers have now practical knowledge of the working efficiency of an electric truck on the farm, and are considering its adoption

The farm is equipped with a motor on a portable truck, which can be moved from place to place and connected up with any piece of apparatus This shows, of course, the practicability of portable electric power on the farm.

The milking tests prove very attractive to the people, and there is always a crowd at the evening milking time. Practical milking demonstrations have been given at large nearby dairy farms, to the great satisfaction of dairymen. The farm is resulting in excellent business, and many of the purchases of electric appliances are traceable directly to the inspiration and information gained there.

Obviously, there were many incidental difficulties in carrying out this ingenious scheme, but with a supply of power always at hand from its own circuits, the company has been able to meet them Like all circuses moving from point to point, the question of transportation has to be dealt with, but here the electric truck has a great chance to prove itself under genuine country conditions. In order to keep the circus going steadily, the company has two tents, so that the next site can be selected and one tent set up before the existing circus is moved on and the other tent taken down. Hence, the apparatus has its home awaiting it, is protected from undue exposure, and can at once hitch to the waiting circuits.

In addition to this "Circus" or "County Fair" of its own, the Boston Edison Company has worked out a kindred idea in its "Edison House," which aims to show the farmer or the suburbanite how electricity can also be utilized indoors as well as out. This model dwelling is portable, and is moved from village to village, being set up in each place with appropriate and pretty floral surroundings. It is always put in charge of some local woman of intelligence, and all the women's sewing bees and local clubs can make use of it—which they do freely. Kitchen, living room, cellar, dining room, bedroom, porch, woodshed, are all equipped thoroughly, and it is difficult to think of any domestic operation that is not here shown under full electrical conditions. It is inevitable that such missionary work should tell in the long run, and that in this way, with the aid of electricity, the farmer's life will be made more endurable, more inviting, more profitable. Edison has said that hoeing corn is, from his experience, one reason why large cities exist. Here are reasons why people will not go back to the farm, because they will never leave it.

A Forest Service Circular on Quebracho Wood

IN response to frequent requests received by the United States Forest Service for information relative to quebracho wood, its uses and substitutes, a short circular has been prepared. Quebracho, an Argentine wood, is very important for the tannin it contains and a need is keenly felt for fuller information regarding it, based upon a scientific study of its structural characters. In general appearance the wood is scarcely distinguishable from two other Argentine woods called white quebracho and red quebracho, which yield tannin in a much smaller quantity. A study of the chief distinguishing characters of true quebracho and these two possible substitutes will prove very helpful in detecting the inferior kinds when they are mixed in with the genuine.

The indiscriminate use of the name quebracho has resulted in much confusion, which called for a discussion in order to clear up the nomenclature of the different woods referred to under this vernacular name. The circular is not a treatise descriptive of the many species of tropical and subtropical woods now known as quebracho, but it is devoted chiefly to a discussion of the distribution, supply, uses, and importation of true quebracho into the United States. Perhaps the most valuable portion of the circular is a clear detailed statement as to how the true quebracho can be distinguished from its substitutes. In a discussion of this kind so many unfamiliar terms are generally employed that the lay reader will not be attracted. The aim of the authors has been to substitute the simplest terms in the discussion of those parts of the wood and its uses which are most likely to be of interest and importance to the general reader and the user of quebracho wood. In this the authors have been successful and the subject is treated in an untechnical and popular, yet accurate, manner.

This study on the structural characters of true quebracho and the spurious kinds, affords an interesting illustration as to how apparently similar woods may be easily distinguished by means of a simple pocket magnifier or a compound microscope. Well selected photographs of magnified transverse and longitudinal sections have been included for the purpose of illustrating more clearly in what respects these woods differ.

Uses for Useless Metals

AN immense fortune, according to economic geologists, awaits the man who can invent a use for tellurium. This mineral is one of the by-products of copper refineries and of plants working up gold telluride ores. At present it is all thrown away, as it is absolutely no good to anybody. Only a few years ago tungsten was in very much the same position as tellurium is now. Then it was found to be highly useful in the manufacture of incandescent lamps and tool steel, till to-day it would seem probable that with a cheaper supply it will become one of our most important minor metals. Selenium is another substance which has just come into its own. Up to a year or two ago no commercially important use for selenium was known, although for some three or four years it was one of the ingredients entering into a secret process in the glass industry. It is now well known among scientists that selenium is an agent in coloring glass red, and in decolorizing glass by the use of small amounts to neutralize the green of ferrous iron. A French scientist has also utilized it in an invention by which pictures may be transmitted by wire. Like tellurium, selenium is a by-product derived from the refining of copper. Apparently about twenty tons a year are now utilized commercially.

The Automatic Word-maker

THE blunders of an inexpert typewriter, regarded as blunders merely, do not at first sight, offer much scope for agreeable meditation, either to their perpetrator or to other people. But regarded as phenomena, physical and mental, they are found to be not only interesting matter for study, but valuable contributions to science and scholarship. For, instead of being the mere accidents of careless or awkward fingers, they are really the product of psychological law, and the creators of a new vocabulary.

There is, for instance, the propensity to write a letter twice over. The finger receives an order to touch a certain key, and responds with twice the service called for; like the genial converser of whom Emerson speaks, who, when he has said a good thing, straightway says it over again.

A modification of the same action is that of following a capital with the corresponding small letter, as *Ccork, Rrome.* One wonders if Aaron, Lloyd and their like might have originated in an analogous way.

Again, when a double letter is called for, the order often seems to have been misunderstood, and the wrong letter is doubled, as *lokk* for look, or *feel* for fail.

Still more singular is the tendency to anticipate in one word a letter belonging in the next, as *lask week* for last week.

The most surprising and amusing effects of all are those produced with machines having "shift-keys" for capitals and figures, when one pushes the wrong lever, and having rattled off what he believed to be the word EDUCATION, sees in its place 3?7?&589, or, intending to date a letter 1910, reads QOQP.

In all these blunders except the last it is easy to detect the principle of the time-element in volition. The operator usually foresees the mistake before it is made, but is unable to prevent it. He knows that he has directed the finger toward the wrong key; but he is unable to recall the order and issue the correct one in its place in time to prevent the result. The finger persists in its course in defiance of its owner's will, finds the key to which he had originally directed it, and prints the obnoxious letter in spite of him. This is one of the commonest and most surprising of his experiences. It is also one of the most interesting from a psychological point of view.

But the psychological result is not the only one accruing from this process. The verbal product is also striking and significant. Along with all this irregular and seemingly haphazard mental action, there emerges an original vocabulary, surprisingly copious and interesting. The typewriter is a prolific creator of new words. Besides the frequent substitution of one regular dictionary word for another, and the production of confused combinations that are not words at all, it turns out a multitude of words that are well formed, pronounceable, and even euphoneous, but which no lexicographer ever heard of

The writer has for many years been in the habit of setting down these machine-made words, as they spelled themselves out under his eyes, until there has accumulated a vocabulary large enough to furnish some new-born nation with the nucleus of a language. From between two and three hundred that have been preserved, not one of them intentionally produced, the following one hundred will serve as examples;

ablo	dera	het	neen	seem
actice	dinf	huse	newa	sporn
af	efaf	ir	nive	stry
agarm	epon	id	ond	stang
ang	ew	ite	ot	stoet
aming	ferly	impuse	ovet	suss
agice	fing	inti	parton	tere
aspa	firat	jud	persol	thar
attan	fird	kint	poan	trem
bak	firt	kep	privare	trult
begil	foing	leace	ract	ud
bereen	fot	libarm	repor	urd
bome	fron	lokk	rhe	vety
cance	gollen	lond	ruter	walg
ciré	geom	manf	savoof	wam
conse	greer	mete	scrim	waw
cre	hace	minf	sevond	whid
deat	hald	mosy	serim	whix
depene	havet	mu	shoy	yont
detiture	hels	ned	sme	yoy

This is but part of the product of a single typewriter, not very constantly used. Every one of these words, and hundreds besides, were absolutely accidental. Many of them were produced several times over, from seven times, and id and ir five times each. Could we add to the list the product of the myriads of other machines, each, no doubt, despite the skill of the most expert operators, more or less prolific of similar creations, we should have material for a new unabridged dictionary and a new language.

A machine for the production of a set of new ideas to fit these unappropriated terms is next in order.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Paraffine for the Obstinate Collar Button

To the Editor of the SCIENTIFIC AMERICAN:

In re collar fastenings, the present collar button works perfectly well if the back of the buttonhole is rubbed with paraffine. A pin, too, if rubbed with paraffine, passes through starched linen "like greased lightning through a barberry bush." W. S. B.

Geneseo, N. Y.

A Card Trick

To the Editor of the SCIENTIFIC AMERICAN:

This is an old favorite this side. It was taught me by an old cavalryman more than fifty years ago. His formula was: "Eight kings threatened to save nine fair queens for one sick knave." This, in my experience, rather more mystifies the beholders than that of "Regular Reader," on page fifty-five of your issue of July 20th.

London, W. C. E. J. KIBBANVITE,
Editor English Mechanic.

An Engineer's View of the Patent Bills

To the Editor of the SCIENTIFIC AMERICAN:

Please allow me to thank you, as an inventor, for the splendid article in issue of August 3rd, 1912, regarding the Oldfield Patent Bill. If you only knew how many inventors need a champion like you I am sure you would feel well repaid. The plain words you use should appeal even to a Congressman. The Government is a plain swindler when it grants us the exclusive right to make, use and vend our inventions, after taking our money, as it does not attempt to make its word good. CLAUDE L. HAGEN.

San Francisco, Cal.

The Automatic Stop on Railroads

To the Editor of the SCIENTIFIC AMERICAN:

The recent disastrous wreck on the Lackawanna at Gibson seems to be only another of the already many and gruesome arguments in favor of the adoption of some form of automatic stop in connection with the block signals. Under present conditions the mere fact that a signal does its work properly is no guarantee that the danger will be avoided, since so much is left to the "human element." Rain, sleet, snow and fog are factors to be considered and have time and again proved the inadequacy of even the most perfect block system. The automatic stop is not new, having been tried and found successful under certain conditions of city traffic, and its general adoption for main line railroad work would not only be an added safeguard to passengers, but moreover would undoubtedly pay for itself in reducing such costly accidents as the recent Fourth of July wreck.

This letter is written in the hope that you will take up in your editorials the question of automatic stops, a measure which seems to be only too urgently needed under the present conditions of fast passenger service.

Sangerfield, N. Y. WILLIAM CARY SANGER, JR.

[This matter formed the subject of an editorial in our issue of July 20th.—EDITOR.]

The Nut Problem

To the Editor of the SCIENTIFIC AMERICAN:

General solution for any number of men, n, and any number of monkeys, m, less than n.

Let x = number of nuts in last quotient.

y = number of nuts originally.

It is evident that we can pass from x to y by multiplying x by n, and then performing, n times in succession, a cycle of operations consisting of multiplying by $\frac{n}{n-1}$ and adding m.

Therefore,

$$y = \frac{n^{n+1}}{(n-1)^n}x + m\left(\frac{n}{n-1}\right)^{n-1} + m\left(\frac{n}{n-1}\right)^{n-2} + m \qquad (1)$$

$$= \frac{n^{n+1}}{(n-1)^n}x + m\frac{n^n - (n-1)^n}{(n-1)^{n-1}} \qquad (2)$$

$$= \frac{n^n}{(n-1)^n}\left[nx + m(n-1)\right] - m(n-1) \qquad (3)$$

$\frac{nx + m(n-1)}{(n-1)^n}$ must evidently be integral $= z$, say (4)

n, x, and y are positive integers.

Also, when z is least in value, x and y are least in value.

Substituting from (4) in (3):

$$y = n^n z - m(n-1) \qquad (5)$$

From (4):

$$x = \frac{n-1}{n}\left[z(n-1)^{n-1} - m\right] \qquad (6)$$

Expanding the parenthesis, n divides formally every term except the last two, which, when n is odd, are $z - m$.

The least value for z in this case is $z = m$. (7)

When n is even, the last two terms are $-z - m$. This expression cannot be zero, and must, therefore, contain n at least once, numerically.

Therefore,

$$\frac{-z-m}{n} = -1 \qquad (8)$$

$$\text{or } z = n - m \qquad (9)$$

which is the least value for z when n is even.

Substituting from (7) and (9) in (5):

$$y = n^n m - m(n-1) = m(n^n - n + 1) \qquad (10)$$

when n is odd,

and $$y = n^n(n-m) - m(n-1) \qquad (11)$$

when n is even.

(10) and (11) give the least solutions.

In order to include other solutions, we must evidently add a term of the form pn^{n+1}, where p may have any positive integral value, including zero.

Therefore, the general solution is:

$$y = pn^{n+1} + m(n^n - n + 1) \qquad (12)$$

when n is odd,

and $$y = pn^{n+1} + n^n(n-m) - m(n-1) \qquad (13)$$

when n is even.

Illustrations

In (12) let $p = 0$; $n = 5$; and $m = 1$,

then $5^5 - 5 - 1 = 3{,}121$, the least value, which is the answer to the original problem.

Let $p = 1$

3,121
$5^6 = 15{,}625$

18,746, the next value, etc

For 4 men and 3 monkeys

In (13) let $p = 0$; $n = 4$, $m = 3$

$4^4 \times 1 - 3 \times 3 = 247$, least value

1 4) 247
subtract (61 + 3)
2 4) 183
(45 + 3)
3 4) 135
(33 + 3)
4 4) 99
(24 + 3)
5 4) 72
18

For 10 men and 1 monkey

In (13) let $p = 0$, $n = 10$; $m = 1$.

$10^{10} \times 9 - 9 = 89{,}999{,}999{,}991$, least value.

SUBSCRIBER

Conservation of the Atmosphere.

To the Editor of the SCIENTIFIC AMERICAN:

A recent article in the SCIENTIFIC AMERICAN attracted some attention on the subject of an exhausted atmosphere, or rather, the depletion of the oxygen from the atmosphere. After reading it, the writer asked a college professor if he believed there was a real danger of exhausting the oxygen in the air.

He replied that he guessed that it would last as long as he did

But this reply will not satisfy the scientist, who is weighing things in scales that weigh a hair, nor the philosopher, who reasons long over trifles light as air. This marvelous atmosphere of ours is not a chemical compound, but a mechanical mixture of two gases, oxygen and nitrogen, in the proportions of 20 and 80 per cent, respectively.

The oxygen being the active element, and the nitrogen the diluent or vehicle for the other gas, the normal atmosphere exists in a balanced state, i. e., the loss of oxygen is continually replaced by the plant life, which has the power, in the presence of sunshine, of decomposing the carbonic acid gas produced by respiration of the animal life into its elements, when the green leaves of the plants absorb the carbon for their own tissues, and restore the oxygen to the atmosphere in its original purity.

Carbonic acid is continually added to the air in the various processes of nature, as respiration, combustion, oxidation, fermentation, putrefaction, and so on. Between the processes just mentioned on the one hand, and the absorbent power of plant life on the other, in the normal state a balanced atmosphere is maintained.

In the wisdom of the Creator this action was to be reciprocally maintained until the end of time, but man has disturbed this beautiful balance by introducing new methods and processes ultra-natural

Ergo, new problems are introduced, which must be considered. How long will this equation stand subtraction on the one side without compensation on the other side? The constant loss of oxygen must be felt, and we claim that the grave increase of germ diseases, and their fatal recurrence, the lack of vitalizing power in the air, the marked climatic changes, the droughts, and fluctuations of temperature, and other variations from nature, are results of a steady consumption of the life-giving properties of the air. Of course, this change would be noticed first by trained observers, then more apparent, and finally be obvious to all. The feverish activity of this commercial age is rapidly consuming stores of coal, iron, and timber, that might last for ages

The intense industrial age in which we live is producing an over-balanced condition of the atmosphere, that must surely react in danger, disease, disaster, and death. But what is the remedy?

Suppose there be none! Just suppose that this acceleration go on, what will it culminate in? For example, the ocean speed craze; the intense rivalry that has existed between the three great lines of trans-Atlantic steamers, Cunard, German, and White Star

We know to our sorrow how that has culminated, in the loss of the mighty "Titanic," ramming an iceberg at midnight, under a speed of 21 knots with the awful penalty of 1,600 lives But who pays the penalty? The American people Take the motor car speed mania Faster and faster, sixty, seventy, a hundred miles an hour. But who pays the penalty? The American people

Aviation is the same; he flew, he fell, he died The same story all around. Acceleration beyond the limit of safety Sad, is it not?

I repeat, the people are unbalanced, and so is the atmosphere in which they live. Let someone disprove it, if he can.

But to return to our problem of the air we breathe sixteen times a minute How shall the atmosphere be conserved?

The air in which we live exerts a normal pressure at sea level of 14.73 pounds to the square inch, which is produced by the super-incumbent atmosphere extending up for possibly a hundred miles. Our life is dependent upon the state of this air. It is capable of a certain amount of saturation, expansion, depletion, infection, compression, exhaustion, and restoration.

Let us notice briefly some of the ways in which the air is vitiated.

First, positively, by combustion. Vast tracts of forest timber have burned down annually, and every acre burned must not only be added to the positive side of the equation in the products of combustion, but also be subtracted from the side that furnishes the power of restoration But to the loss of vegetation, by which the carbon dioxide is separated, there is an additional loss of moisture-producing medium to furnish aqueous vapor Where is this loss compensated?

Second, negatively, by loss of aqueous vapor This is essential to health, as the electricity in the body is rapidly dissipated under certain conditions. And disease is induced Saturation beyond a certain point reacts toward depression. Natural balance is maintained by the sun and wind, and evaporation; the air taking up all the moisture it is receptive of, and conveying it over wide areas

Third, absolutely, by depletion or exhaustion, and by infection The cities are filled with air-depleting plants, that exhaust the natural restorative properties of the atmosphere Hundreds of power plants, foundries and furnaces exhaust the oxygen and electric properties of the air, while loading it with the suffocating products of combustion. Smelters consume the vital, and add the lethal.

By infection the air takes up bacteria in dust, and distributes them widely along city streets, and in crowded stores and offices, on trains and otherwise The system depleted of vitality cannot resist these unseen invaders, and easily succumbs to disease Of course, the total amount of oxygen in existence is not lessened, but is rendered inoperative.

The final question to be met is regarding conservation and restoration of the atmosphere How to conserve and how to restore? If natural law could prevail, a balanced atmosphere would be maintained, but it is a serious question indeed.

Closely allied to this are the problems of forest conservation and water storage, which we hope to take up in a future article

We respectfully submit that there are certain inalienable rights declared in the immortal document and secured under the Constitution as being common to all men. Among these are life, liberty, and the pursuit of happiness The right to live and to be free and happy

Necessary to life and enjoyment of it is health, and this cannot long be maintained under the adverse conditions of impure water and infected air Much has been done to secure a supply of pure water in our cities, but the air is just as much a common menace as ever. There are times when the only breathing places are the parks, the river front, and the shore; but how many of the poor never see them.

Air is the universal medium of life, and as such should be properly conserved, like any other universal privilege.

"All experience has shown that mankind will suffer, while evils are sufferable, rather than to alter or abolish the evils to which they have become accustomed."

Schroon Lake, N. Y WILLIAM MARSH.

The Harbors of the Pacific Coast

Terminal Facilities for the Panama Canal Trade

By Wm. Hosea Ballou Sc.D.

THE coast line of the Pacific coast of the United States is defined by the United States Coast and Geodetic Survey as 1,852 miles long from headland to headland, and 8,800 miles long with indentations. Originally its natural harbors may be said to have been confined to San Francisco, San Diego, those on Puget Sound and the Columbia River. As populations increased in California, Oregon and Washington, there was a corresponding growth in water-borne traffic, and Congress, from time to time, made appropriations for the improvement of rivers and harbors. Oregon has received the greatest sum, $24,500,000, California's appropriations have totaled $19,300,000, and Washington has been granted $10,175,000.

To the above should be added the immense outlay for railway terminal wharves, municipal wharf systems, and the expenditures by corporations and individuals, bringing the approximate total up to probably over $100,000,000.

State of Oregon.

PORTLAND HARBOR.—Portland is located on the Willamette River, 12 miles above its entrance into the Columbia River, which is 110 miles from the mouth of the latter, and at present is the head of deep water navigation. Light-draft boats may ascend the Willamette 150 miles. By using the State portage road between Celilo and Big Eddy, they may ascend the Columbia and Snake rivers during higher stages for an additional 537 miles, this last stretch being the greatest of American logging and rafting waterways. Logs from 20 to 90 miles inland are floated over tributaries to saw and shingle mills upon its banks. Rafts of logs and piling timbers, of 6,000,000 feet each, are towed over it during the season, and thence by ocean to California ports. The annual commerce amounts to eight million tons, valued at $75,000,000, of which a little over one half is sea-going.

Congress is asked to appropriate $1,844,000 additional for use this year in continuing the jetty work at the mouth of the Columbia River, bringing up the total expenditure to date of $11,488,000. More than as many millions will be required before this important entrance is under permanent control, and it is doubtful if its annual maintenance for dredging, etc., will ever be less than at present, about $105,000. Of the projected seven-mile jetty (the longest, by far, ever conceived), only about 19,000 feet were completed on the first of June, leaving some 18,000 to be constructed on the ocean end, in at least 40 feet of water. When it is finished, there will be still the north jetty to build—two thirds as long, and as costly. At the present rate of construction, it will require twelve years to complete the present south jetty and sixteen years to build the north jetty. Thus, a total of twenty-eight years must elapse before Portland can hope for a 40-foot channel such as admits shipping to New York harbor. Of its vast utility and necessity, however, there can be no doubt. The mouth of the Columbia River, which it is to control when completed, is 8,000 feet wide. The navigable channel within it swings like the nervous coils of a snake, moving its position 2,500 feet annually, first one way and then back again. The necessity of jetties on both sides, to compel the channel to remain in one place, is thus shown, so that by the use of dredges, it may be kept at the required depth.

COOS BAY.—Coos Bay is the second Oregon harbor in size, and it presents no especial natural difficulties to overcome. Vessels drawing 22 feet of water may now cross the bar at high tide, enabling the port of Marshfield to handle, last year, 300,000 tons of freight and 25,000 passengers, between it, San Francisco and Portland. The harbor is 180 miles south of the mouth of the Columbia River, and it is the principal ocean port of Oregon, being located in the center of or adjacent to the vastest forest region and the most fertile valleys.

The Coos jetty has a history far more inviting than that of any other on the Pacific Coast. When its construction was commenced in 1879, there were only 10 feet of water on the bar. The first project called for 1,760 feet of jetty, which was speedily built, at a cost of only $213,750. As the channel still continued movable, tortuous and unstable, Congress in 1890 ordered the north jetty continued to a length of 9,600 feet and the construction of a south jetty 4,200 feet long. The extension of the north jetty was completed in twelve years, at a cost of only $721,720, of which $196,721 was for maintenance. The channel deepened naturally and became stable, so that it was not necessary to construct the south jetty. Deducting maintenance, it will be seen that the actual cost of this jetty was only $77 per foot. After a lapse of ten years, the condition of the jetty is practically normal. Its eurockment has only slightly subsided. Its tramway and receiving wharf only have been destroyed, the result of the work of the teredo and consequent decay.

State of Washington.

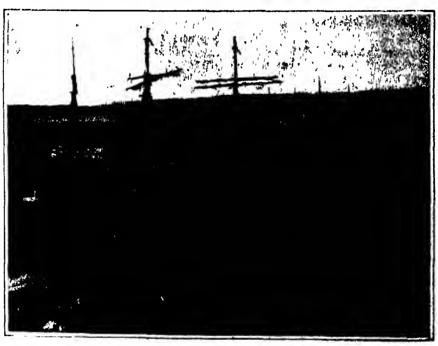
TACOMA HARBOR.—Tacoma has one of the deepest harbors extant, ranging from 200 to 600 feet in depth. At the south end of the harbor are extensive tidal flats, bare at low water. The city water front is along the southwestern shore and the harbor lines have been established around the south end of the bay and along its western side. Several waterways extending into the flats have been projected, of which the most important, the City Waterway, has been completed at a cost of $162,480. Its depth varies from 25 feet to 15 feet at its south end. Tacoma's great harbor problem remains unsolved, and has languished for three years. This project called for the deepening to 28 feet of the Puyallup waterway for a width of 500 feet and a length of 3,650 feet. When one half of the work was completed, at a cost of $159,585, freshets brought down such large deposits in November, 1909, that the 1,811,589 cubic yards dredged were replaced by more than 1,000,000 cubic yards of debris. All work was then stopped and the channel has since refilled. A board of government engineers decided, after a survey, that the only solution of the problem was to divert the bed of the Puyallup River and have it empty elsewhere than into the waterway of that name. As such diversion is not comprehended in the scope of Government operations, it will never be done unless private, city or State interests do it. Meantime, Tacoma is going ahead with its wharf terminals on an extensive scale, leaving the Puyallup for later consideration.

GRAYS HARBOR.—Grays Harbor is the name of a top-shaped bay fourteen by seventeen miles in area, forming the mouth of the Chehalis River. On it are located the thriving sawmill cities of Aberdeen, Hoquiam, Cosmopolis and others, which contribute about 800,000 tons annually, mostly of lumber products, to commerce. Here the usual jetty problem was encountered at the outset, a convex bar having primevally formed two miles out at sea, across a channel about 100 feet deep, diminishing landwards to 30 feet. The two

Lake Washington canal, Seattle, showing the cofferdam and lock-pit.

Vessels of the Pacific grain fleet in Portland, Oregon, harbor.

Filling in the shallows at Los Angeles harbor.



Typical shipping scene at Long Wharf, Oakland, Cal.

entrances through the bar had 12 to 13 feet of water, periodically shifting. In 1896 Congress authorized a south jetty three and a half miles long to control the tidal currents existing between two sandy peninsulas, 12,500 feet distant from each other. In 1902, when the $1,000,000 authorized for the work had been expended and 13,784 feet of rubble-stone jetty completed, further work on it was abandoned. In 1907 Congress authorized a north jetty of 9,000 feet length, and, in 1910, its extension to 16,000 feet, to bring up its outer end opposite of the end of the south jetty. Local interests contributed the land for the trestle approach and operating plant. The jetty trestle is at present 12,784 feet long and the enrockment finished up to 9,376 feet, 8 feet wide at the crest, to the mid-tide level. Nature offers no such tremendous opposition and difficulties here as at the mouth of the Columbia River; but, for that matter, it is doubtful if the latter has any rival extant for battering and destructive powers.

SEATTLE's engineering problems do not call for much comment. The harbor works concern two fresh-water lakes, Union, within the city, and Washington, on its borders. A navigable connection with Puget Sound is proposed for the former, and the improvement of the Black and Duwamish rivers forming the connection of the latter. A channel has been dredged, 50 feet wide and 16 feet deep, between the Sound and the wharves at Ballard, in Salmon Bay, a distance of 2,000 feet, with a turning basin 175 to 500 feet wide. A cut has been excavated between Lake Union and Salmon Bay to control the water level of the former. From Ballard to the lock site the channel is 75 feet wide and 16 feet deep. In June, 1910, Congress authorized the construction of double locks to be located at the entrance to Salmon Bay, and an unbroken channel-way therefrom, through Salmon Bay and Lake Union to Lake Washington. The channel, or canal, is to lower Lake Washington to the level of Lake Union. The cost estimate was $3,555,000, of which Congress appropriated $2,500,000, for the locks and accessories only, Seattle agreeing to pay for the channel work and to secure the government from all damages for lowering Lake Washington or raising the level of Salmon Bay.

California.

SAN DIEGO.—San Diego's bar was originally cut by a natural channel 500 feet wide and 21 feet deep at mean low water. In 1875 Congress appropriated $80,000, with which a dike was thrown across the mouth of the San Diego River for the purpose of preventing its deposits from injuring the harbor. In 1890 Congress authorized the construction of a 7,500-foot jetty on Zuninga Shoal, at the harbor entrance, and the maintenance of a channel 24 feet deep. When this project was completed, the channel first deepened from 26 to 28 feet, then subsided to 24 feet. Continued dredging increased the maximum depth to 27 feet. The average tide here is 4.8 feet, as against 18 feet in the Pacific Northwest. In 1910, Congress authorized a channel 30 feet deep at the outer bar and 600 feet wide, so as to admit the Pacific squadron and enable the warships to coal at La Playa. This work will be completed by the time of the opening of the Panama Canal and the Panama-California Exposition at San Diego in 1915. The harbor has an area of twenty-two square miles, ceded to the city by the State. The city has appropriated $1,000,000 for a modern wharf system, with wharves 1,000 feet in length each and an additional sea wall 25,000 feet long. There are still 1,000 acres which can be utilized for commerce. A belt line railway is being built along the entire water front to facilitate the movement of freight.

LOS ANGELES.—Los Angeles harbor was created by the annexation of San Pedro's outer and Wilmington's inner harbors. Originally San Pedro Bay was an open roadstead, protected on the west by a bluff known as Point Fermin, but exposed from other directions. In 1897 Congress made available $2,900,000 to build a breakwater from Point Fermin 8,500 feet out into the Pacific Ocean. The fund was sufficient to extend the breakwater 9,250 feet from Deadman's Island, to terminate in 40 feet of water. This portion of the work consists of two straight arms, connected by a curve 1,800 feet long, having a radius of 1,910 feet. The westerly arm is 3,000 feet long, the easterly arm 4,450 feet long. Deadman's Island has been connected with the mainland by continuing the breakwater to 11,275 feet in length. The breakwater is 122 to 194 feet wide at the base, 38 feet wide at low water and 20 feet wide on top, 14 feet above low water. This breakwater can only be described as one of the greatest extant, creating, as it does, a magnificent roadstead out in the ocean. To construct it 2,563,777 long tons of rock were used, with rocks weighing three tons each and upward.

On invitation, Mr. Irving T. Bush, projector of the Bush Terminals of Brooklyn, has inspected Los Angeles' harbors with a view of suggesting how they can be made to anticipate the further increase of trade to result from the opening of the Panama Canal. He recommends the construction of a wharf three-quarters of a mile long. Such a wharf would be 2,900 feet longer than any now extant. The city has now twenty-two miles of improved water front.

SAN FRANCISCO.—San Francisco has the great advantage that it is a practically natural harbor. The Government has never had to concern itself in its behalf, except to remove rocks, which mostly protected above water, where they could always be seen and avoided. This natural harbor is forty miles long and from three to ten miles wide, with thirty-six square miles of anchorage area, ranging from 40 to 90 feet in depth. Its main entrance, Bonita Channel, has a permanent, unshifting depth of 48 feet, which never has and probably never will require a dredge. It has other channel entrances also, none of which have less than 30 feet of depth. The only impediments to navigation were the rocks mentioned, marked with buoys or lighthouses. Of these, Blossom, Arch and Shag rocks Nos. 1 and 2 have been removed to a depth of 30 feet, and also Noonday rock, thirty-three miles west of the entrance. Work was stopped on Rincon rock at a depth of 24 feet, when the city took the base over for a wharf and included it in the pier-head line. In 1910 Congress authorized a depth of 40 feet of water to replace Centissima rock, in Bonita Channel, and 35 feet of water in the place of two rocks near Mail Dock. In this work $515,928 have been spent and $250,000 more have been authorized. It is evident that San Francisco harbor must remain the only one on the Pacific Coast, for many years, that can admit the largest of the world's vessels.

OAKLAND.—Oakland commenced harbor building in 1874, and work has been done intermittently ever since. It is now a greater harbor than it has commerce for, and speculation is rife as to what benefits will accrue from its future enlargement. As it is, 64 per cent of its tonnage goes on ferry transfers across the bay, consisting of overland freight consigned to San Francisco. The harbor is essentially the San Antonio estuary, an arm of San Francisco Bay. The project of 1874 resulted in the construction of two high-tide training walls at the entrance, a tidal canal one and a half miles long and 400 feet wide, connecting with San Leandro Bay, a tidal basin with a channel to San Francisco Bay and three steel bridges across the tidal canal. Next, a number of channels were excavated into Oakland and the jetty was extended 500 feet. Since then canals and waterways have been deepened, the main channel to 30 feet and the widening processes have been continued up to 500 feet. To-day the tidal canal has been extended to four and three quarter miles in length, the channel around the tidal basin to two and three eighth miles and the channel in the tidal canal to two and one quarter miles. Congress has authorized further improvements to the extent of an additional $705,482, and has appropriated $150,000 of it to be spent this year.

The Pacific squadron assembled in San Diego harbor.

City Planning Congress at Duesseldorf, Germany, 1912.

DUESSELDORF, the most beautiful and modern city in western Germany, known as the "Park City" and the center of the industrial empire with its extraordinary commercial and political developments, probably without a rival throughout Europe, is at present holding an exhibition on city planning, city operation and city administration functions.

The exhibition will last from June 20th to October 31st, while the International Congress will be from the 23d to the 28th of September.

The first group of exhibitions consists of general ground plans, traffic systems, such as railways, local and express facilities, elevated, subway, suspension and street railways, aviation stations, city embellishment, bridges, docks, parks, lawns, forests and real estate politics.

Under city operation are grouped: Gas works, water works, electric central stations, sewage systems, street cleaning, refuse disposal, cemeteries and crematories.

Under the third group, administrative functions, are exhibited plans and models of hospitals, rescue homes, poor houses, lodging houses, orphan asylums, homes for widows and the aged and infirm, schools, churches, museums, art galleries, libraries, concert halls, etc.

It will be noticed from the foregoing items that this exhibition is planned with the well-known German thoroughness so that hardly any subject is omitted that is of importance in city planning, city operation and administration.

The addresses and papers will be read in the principal languages, German, English, French, etc.

Lieut. Scott Wins the Bomb Prize.

THE trials for the $5,000 Michelin prize for bomb dropping from an aeroplane at a height of 2,400 feet ended at Châlons on August 11th in an American victory, subject to confirmation by the French Aero Club. The winner was Lieut. Scott of the United States Army. Scott dropped the bombs three at a time. The first three fell outside the target, which was a rectangular space 170 by 40 feet. Subsequently Scott succeeded in dropping eight projectiles within the target. Readers of the SCIENTIFIC AMERICAN will doubtless recall a very interesting article that Lieut. Scott wrote for us about a year ago on his method of dropping bombs.

New York's Double Deck Car

LAST spring there was introduced in the streets of New York a peculiar low street car, which gained for itself the name of the "hobble-skirt" car or the "stepless" car for the reason that it was hung very low, and hence required no step between the street level and the floor of the car. This result was obtained by placing the driving motors at the end of the car and the car body between them. The entrance to the car was at the center.

When it was found that the low stepless car was a success, it was only logical for the next improvement to consist of an upper story placed over the low car. By an ingenious disposition of the various parts a double deck car has been evolved which is only seventeen inches higher than the ordinary car that runs up and down Broadway At each end of the car are the stairways that lead to the upper deck Here there are two long seats running the entire length of the car, and arranged back to back Thus the aisles of the upper deck are at the outside, whereas the aisle of the lower deck is in the center, where there is plenty of head room directly under the seats of the upper deck The seating capacity of the new car is 88 passengers, and there is standing room for about 80 more The seating capacity of the long open cars now in use is 60, and of the short ones, 50 While the long closed car will seat but 36 and the short ones but 28 The pay-as-you-enter-car has room for 41 to 47 seated, and the single deck stepless car has seats for 51

While the double deck car is a decided innovation in this country, it has long been in use in Europe. However, the design is decidedly different; in our car the stairways are placed at the side and are entirely enclosed, so that the passengers need experience no timidity about climbing from one deck to the other In mounting from the lower to the upper deck the passengers have to rise less than two feet more than they would in boarding an ordinary car. The upper deck of the car is roofed in, but the sides are open, except for a protective netting In the winter time this will be replaced with solid panels and windows. The car is now being tested to determine whether it can be unloaded and loaded rapidly enough, particularly from the upper deck As the only exit and entrance to the car is at the center there may be some difficulty from congestion at this point If it is found that the car may be readily unloaded and loaded there is no doubt that many cars will be ordered for use on the crowded streets of New York Thus, in economizing in the number of cars operated, there will be a material economy in operating expenses, and added to this there will be less congestion of the streets, and consequently a more rapid transit

Stairway to upper deck.

New York's new double-deck car. Only 17 inches higher than the ordinary car.

East African Cedar for Lead Pencils

THERE are about twenty lead pencil factories in and around Nuremberg, Germany, which consume approximately 100,000 tons of cedar wood annually. All of the lead pencil factories in Germany excepting one small concern at Regensburg are located at Nuremberg For 250 years the operators of these factories have been dependent on America for their supply of pencil cedar, which includes the northern red cedar (*Juniperus virginiana*) and the southern red cedar (*Juniperus barbadensis*). Suitable woods from other sources have been sought for a number of years, but none have ever been found that were so satisfactory, or that approached in quantity and quality the cedars of the eastern and southeastern United States It has recently been announced, however, that this dependence on the American product is almost at an end, since the extensive Schume forests of cedar (*Juniperus procera*) in German East Africa are being exploited. These forests are said to furnish a wood equal in quality to the average grades of the American cedars and sufficient in quantity to satisfy the needs of the German factories for a good many years to come.

The German government had an investigation made of these forests with a view to developing them and to render the timber supply available for use. It did not lose an opportunity to make known this large supply of cedar wood, and a concession has recently been granted to a company for the exploitation of this valuable timber. The company has constructed a cable-tram line at a cost of nearly $400,000, for the purpose of bringing the logs to the mills. It is the steepest cable-tram line in the world, and is said to be a masterpiece of engineering skill. The line is now being successfully operated, and the cedar logs are converted into lumber and transported by rail to the port of Tanga, in Usambara. From here it is shipped by the steamers of the East African Line to Hamburg—the principal distributing point.

Many government officers have tested the lead pencils made from this African cedar and have approved them; the Prussian ministries of finance and of the interior both have recommended that pencils made from East African cedar should be given preference. Practically all the leading German lead pencil factories are now using some African wood, and the pencils made from it are pronounced to be equal to those made from the American cedar.

Water-skating

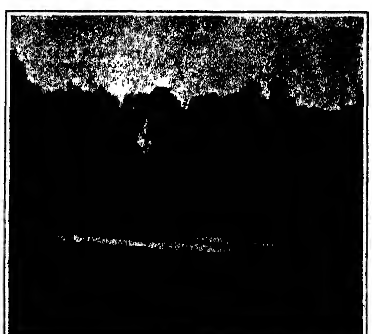
ATTEMPTS have often been made to design some means for enabling man to walk on the surface of water, and especially during the last few years a number of "water-skates" have been invented for the purpose However, all these designs showed the drawback of possessing a weight much too high, their dimensions were too great and transport too inconvenient and difficult over land to allow any pleasurable sport. In fact, the prospects of this fascinating water pastime were anything but promising.

However, on the Lake of Gross-Wusterwitz, in the Prussian Province of Saxony, water skaters moving with surprising agility have now made their appearance in great numbers. They use a novel type of non-rigid water skate constructed by the Deutsche Wasserlaufschuh-Werke, which may be said to eliminate all the drawbacks so far inherent in this mode of locomotion. These compressed air water-skates which embody the results of many years' studies and indefatigable experimenting, look very much like skis, have strikingly low weight and small dimensions, and accordingly allow the skater to glide on the water with an extreme ease. While in ordinary rowing one has to turn his back to the direction of motion, water skating has the additional advantage of allowing the face to be turned forward, so that the eye on account of the erect position can sweep freely over a wide expanse of water. A further advantage of the new water-skates, which on account of their low weight are readily transportable, is the possibility of folding them up into a small and extremely handy bundle, after allowing the compressed air to escape from the floats (consisting of pointed caoutchouc cylinders and rubber-coated sail-cloth covers). They are pumped up again and mounted for use with the same rapidity and ease.

At the underside of the water-skates are attached movable fins which by opening at every move, enable the skater to slide on with the utmost facility. Another possibility which affords additional variety is to use alternately or simultaneously with the work of the legs, a light paddle endowing the skater with a mobility attained by no water craft. Everywhere, even on the most frequented waters, will the skater be able swiftly to make his way through the crowd of ships and boats.

Water-skating in this new form seems to be anything but a dangerous sport. The feeling of absolute safety which is experienced by the users of water-skates is based in their very construction: The keel running underneath the water-skate (and tied up to the latter) insures a very sufficient stability, excluding any risk of tumbling. In fact, no fall or other accident has so far occurred on any one of the numerous trips made on water-skates nor in connection with the exercises of beginners even in rough water. However, provision has been made even for the remote possibility of an accident. In order not to be hindered in swimming the skater is, in fact, able with a single move to free his feet from the water-skates. The only back motion of the locking lever required in this connection is effected without difficulty and with an absolute safety in any position whatever. A safety device prevents any involuntary detachment.

Water-skates folded up for easy transport.



Gliding on the water may be assisted by a light paddle.

German and French Airship Rivalry

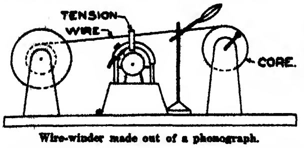
THE fact that one of the Berlin papers stated that Germany now had as many as 27 balloon sheds for airships, led the Paris daily *Le Matin* to resume the question of relative strength of these rival countries. Germany is laying great stress on the airship question and appears to prefer the airship as being best suited to the national character. The 27 airship hangars appear to lie mostly on the frontiers of the country, headed by the great Friedrichshafen hangar which takes two Zeppelins, then come Hamburg, Frankfort, Metz, and others. New hangars are planned at Wilhelmshafen for large marine airships gaging 25,000 cubic yards. It is difficult to say just how many military airships Germany possesses, for these are often transformed and their names changed, but there are probably not more than ten or a dozen fit for use. France has nearly the same number at present, and there will soon be three new airships finished. As to the hangars, there are 8 on the east frontier and many others in the Paris region or elsewhere which make about 20 in all. The position of the two countries is about equal as to the number of airships and hangars. Germany is spending large sums in this direction, and this is not the case in France, for the most of the attention is given to aeroplanes.

A Simple Wire-winding Apparatus

By Norman Barden

WHEN the amateur experimenter starts to building coils, the winding of the wire generally looks like a great task to him; and so it is when the wire to be wound is small and hundreds of feet are to be coiled. It so happened that the writer was interested in the making of a large ozone generator which had to be finished in a very short time. The secondary was to consist of 10,660 feet of No. 40 enameled wire. How to wind the wire in a short time without breaking it or having any laps in the winding was the problem.

The driving mechanism of an old model Edison phonograph was brought into use, and made to guide the wire and at the same time to keep it taut. This was done in the following manner: A tension was fastened to the bridge that carries the needle. The



Wire-winder made out of a phonograph.

machine was placed so that the tension was about three inches from the core, which had been put between centers as shown in the accompanying figure. The speed of the machine was then slowed down so that the core could be turned about seven times while the tension moved to the right a distance of one fiftieth of an inch, i. e., while the record cylinder made one revolution. In this way the wire was wound on the core, which was three inches in diameter, in one afternoon. A magnifying glass was used as shown in the figure to assist in watching for any kinks in the wire.

It was surprising to find how well the work could be accomplished when one person turned the core and another regulated the speed of the machine and watched for any trouble in the winding. With this arrangement, as soon as anything went wrong, the one turning the core would immediately stop, and the other person would drop a little paraffin on the wire on the core to prevent it from becoming loose. A part of the wire could then be unwound and the trouble fixed with no fear that the rest of the winding would be loosened. It was also found necessary to have the distance between the core and wire reel as short as possible. The shorter this distance the less danger there is of the wire's breaking. This last applies especially to the winding of the finer wires. Two other factors are to be taken into consideration. These are that the reel must turn very smoothly and easily, and that the winding must be done evenly and not by jerks.

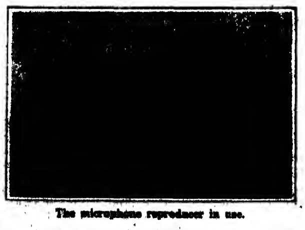
A Simple Microphone and Reproducer

By C. C. Kiplinger

HEREWITH illustrated is a simple microphone and also a rather unusual application of this interesting instrument. It comprises two short lengths of ⅜-inch electric light carbon. These are inserted in each end of a bit of ⅜-inch rubber tubing.

The ends of the carbon rods within the tube should be about ⅛ inch apart. This space is loosely filled with granular carbon free from dust, obtained by crushing arc-light carbons in a mortar. The granules should not be more than one thirty-second inch in diameter. The pressure on the particles may be varied by shifting one of the rods.

Copper wires are twisted tightly about each rod to



The microphone reproducer in use.

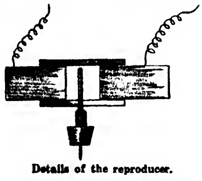
serve as connectors. If the carbons are copper-plated the wires should be soldered to the plating.

The instrument is connected in series with a telephone receiver and a battery of a half dozen cells. When the microphone is properly adjusted, a very small disturbance of the carbons will cause a corresponding movement of the carbon granules, and the resistance offered to the current will change. This causes a sound in the receiver. A cigar box provides a good sounding board for the apparatus.

With a slight modification, this device becomes a first-class reproducer for a gramaphone. The sound waves engraved on the record may produce electrical vibrations, which in turn, are reconverted by the telephone receiver into sound waves in air. A loud-speaking receiver will make these audible to a large audience.

A small slit is cut in the center of one side of the rubber connector. A short piece of three sixteenths inch brass tubing is flattened for a part of its length by hammering, and the flattened end passed through the slit so that it just clears the opposite side of the cavity. The flat surfaces of the tube should be parallel to the ends of the carbons. A small cork and needle are attached to the other end of the tube, as shown in the sketch.

The photograph shows the apparatus in working order. It is supported by a stand, a heavy wire, and a counterbalance of some sort. The connecting wires should be very flexible, so as to offer little resistance to the motion of the microphone. The sound waves inscribed on the record are transmitted to the carbon granules by the needle and brass tube. The receiver



Details of the reproducer.

may be at a distance from the reproducing microphone.

Very interesting results are obtained by changing the angle of the needle with reference to the disk, so that the record may be run in the opposite direction. The vibrations are reversed in order, as are the vocal inflections, producing in many instances extremely ludicrous effects.

Etching Glass With Hydrofluoric Acid

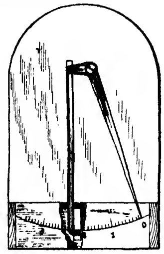
By Norman Barden

IT is sometimes desired to etch a small design in a piece of glass or a label on a bottle. To do this on small pieces of glass, not larger than twelve inches square, does not require a great deal of expensive material if done in the following manner: The glass piece to be etched is first covered with a thin layer of paraffin wax or beeswax. The design to be etched is drawn on a piece of glazed paper with a soft pencil. The drawing is now placed against the wax coating and is rubbed all over the back with some blunt instrument. On removing the drawing, the design will be clearly seen on the wax surface. The design is now cut in the wax, i. e., wherever the glass is to be etched, it is cut free from wax. Now, as to the etching, this can be done in two ways. The first method to be described is very convenient for etching small designs and graduation marks, as on thermometers and special graduates. A tuft of cotton is fastened to the end of a piece of copper wire. With this, hydrofluoric acid is swabbed over the design until it is etched the proper depth. The operation must be carried out in a well-ventilated place or in a slight draft. The fumes of the acid should never be breathed, and the acid itself produces severe burns if it touches the skin. Commercial hydrofluoric acid is obtained in paraffin-lined bottles, and must be kept in these containers or in gutta-percha flasks. For the larger pieces of glass to be etched, it will be found best to do them in the following manner: Finely crushed calcium fluoride or fluorspar is sprinkled over the bottom of a shallow lead tray. A lead tray can be easily made from sheet lead by bending the edges up to form the tray sides. Over the fluorspar is poured concentrated sulphuric acid. The spar does not have to be entirely covered by the acid. After the design has been prepared the glass plate is laid, face down, on the lead tray. It is best to have both sides of the plate covered with the wax when the etching is done, in the following manner: To etch the glass, apply gentle heat to the pan. This may be done with a spirit lamp or the Bunsen flame. This operation should be carried out in the open or under a hood in connection with a chimney or an exhaust fan. The etching in this last case is done by the hydrofluoric acid vapors that arise from the heated fluorspar and sulphuric acid. The one great caution in etching glass is not to inhale any of the acid fumes and never let the least bit of the acid come in contact with the skin.

A Home-made Hygrometer

By C. S. Meeker

THE accompanying engraving illustrates a home-made hygrometer constructed by the writer more than thirty years ago. The instrument worked well for twenty-five years when it was accidentally broken. The instrument consists of a baseboard upon which is mounted a pointer cut from sheet metal. The pointer is ten inches long and is provided with a lateral arm



Hygrometer with wooden expansion member.

at the pivot end one inch in length. The end of the pointer passes over a scale at the bottom of the baseboard, graduated in tenths of inches. The short arm of the pointer is fastened to a piece of clear soft pine, ½ inch square, cut with the grain running crosswise. The lower end of this pine stick is fastened to a stud which passes through a slot in the baseboard and is adjustable therein to bring the pointer to the zero mark on the scale. The pine stick was dried in a kiln and after being taken out was allowed to cool, when it was set at such an adjustment as to bring the pointer to zero on the scale. An expansion of one 0.01 inch in the wood would cause the pointer to move 0.1 inch. The instrument was placed in a shed where neither rain nor sun could reach it. On several occasions the pointer stood at zero and at one time it reached as high as two and two-tenth inches, showing, therefore, an actual variation in the length of the stick of over a fifth of an inch between the dry and damp weather. The device was not made as a hygrometer, but was constructed primarily with a view to ascertaining the expansion and contraction of timber.

Improved System of Filtering

By Clarke E. Davis

THE large inverted bottle shown in the cut is fitted with a two-holed rubber stopper, through one hole of which passes a short glass tube extending upward just through the cork and downward to the funnel. In the other hole is inserted a glass tube, which reaches to the bottom of the bottle and terminates at the other end in a piece of rubber tubing fitted with a clamp.

This clamp serves to regulate the inflow of air,

Filter with regulated air flow.

which controls the outflow of the liquid. The funnel is supplied with an ordinary plaited filter.

This system of filtering is advantageous because it may be started and it will take care of itself to completion, thus enabling one to filter the various precipitated reagents, etc., while conducting a session or enjoying a meal.

Inventions New and Interesting

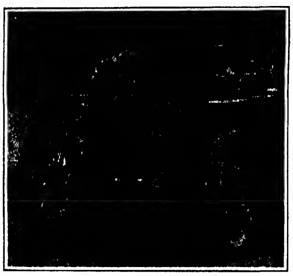
Simple Patent Law; Patent Office News; Notes on Trademarks

Self-starter Device for Automobile Engines

By Theodore M R. von Kéler

THE difficulty of starting a powerful automobile engine on a cold day by means of an ordinary hand crank has been brought home with considerable force to those owners or drivers of high-powered cars who operated their cars before the arrival of the various systems of self-starters which now are on the market. And even now, despite the presence of several systems of starting devices, the difficulty is by no means fully solved, for even the most perfect ignition, piston pressure or electric device made, will balk occasionally Any invention, therefore, which promises to do away with at least some of the troublesome difficulties encountered, deserves careful investigation.

Differing radically from every other motor starting device so far brought on the market, the Air Starter contains features which never before have been brought to a practical test, but which appear so logically correct that one cannot refuse them due consideration. The device, which is manufactured by a Detroit company, recently was exhibited in New York city streets, attached to a sixty horse-power, four-cylinder touring car. In several hundred demonstrations the apparatus worked without a hitch.



The position of the air starter supported on the springs in front.

The device consists of a small two-cylinder opposed air compressor, a compressed air tank and the air crank. This last named part of the invention is the most radical departure from accepted designs of compressed air starters. Instead of forcing compressed air or exhaust gas into the tops of the cylinders themselves, and forcing the pistons down by this means, the air crank simply replaces the human arm on the crank handle and turns the crank by means of a mechanical arm. How this is accomplished is clearly visible in the accompanying diagram

The air crank consists of a semi-circular cylinder in which a piston is free to move in an arc of about 160 degrees. The piston is firmly attached to the crankshaft by means of a cranking arm fitted with a rachet device When compressed air from the tank is admitted into the cylinder—which is accomplished by simply pressing a button on the foot board —the piston is pushed around with great speed and power until the cranking arm hits the bumper, which movement is equal to turning the engine over two or three compressions As soon as the bumper is touched the rachet device is disengaged and the long helical spring returns the cranking arm and piston to their original positions. In case of a back fire before the arm has reached the end of its turn, the ratchet is also disengaged by contact with a tripping pin acting as an automatic release, and the crank arm returns to its normal position.

In addition to cranking the motor the compressed air tank is arranged so as to accomplish other work around the car. A hose valve on the dash, and a length of flexible hose with a tire gage for filling the tires, dusting the car, etc., are provided. An air signal can be connected, powerful emergency air brakes attached, constant pressure supplied for the gasoline tank, etc. By simply pressing a foot button when the car is running, the driver can connect the compressor at will It is claimed that operating the compressor for about five minutes two or three times a week is sufficient to maintain a pressure of 250 pounds in the storage tank. An air gage on the dash indicates the pressure.

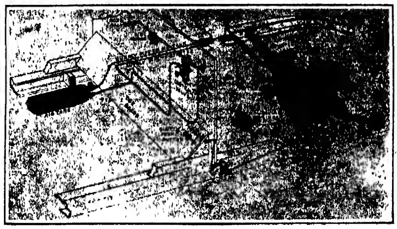


Diagram of installation of air starter device, showing connections between air crank at the right and air tank push button.

A Tractor Steering Device

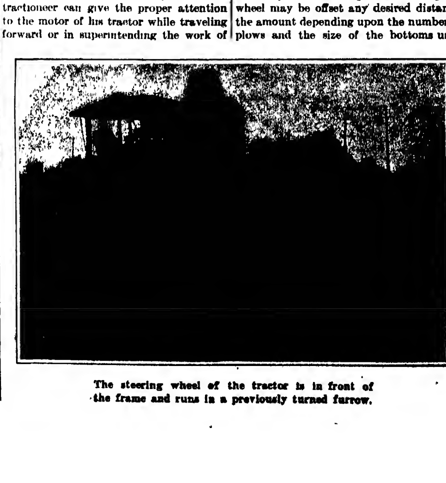
THE growing use of tractors and the scarcity of reliable trained help has led to the invention of a substantial device that automatically guides a tractor in plowing or in breaking and does it even better than the average man can do it. At the same time it makes it possible for one man to operate both engine and plows. The tractioneer can give the proper attention to the motor of his tractor while traveling forward or in superintending the work of his plows, as the occasion requires, and the tractor equipped with such a guide turns straight furrows of equal width.

The guide is made of high carbon channel steel securely braced and bolted together The principal factors are two ¼-inch × 5⅛-inch × 4-inch channel steel beams, 13 and 14 feet long, respectively, bolted to each other by brace rods of the same size material, so as to form a triangular frame

At the front end of this triangular frame is a single wheel and a long steel shoe The wheel runs in the previously turned furrow —hugging the "landside"—and by the leverage it exerts on the axle, keeps the front wheels in line. The distance from the tractor to the furrow is easily regulated by a simple adjustment of two arms on the angular frame

The shoe at the front end of the frame affords protection against any accident to the guide should the wheel drop in a hole or strike an obstruction. It also keeps the device free from weeds and other trash. If the guide should strike a hummock, there is no chance of it doubling up, because the shoe will assume the burden and hold it until the wheel once more has smooth footing. The front wheels are held firm, that is, kept from see-sawing.

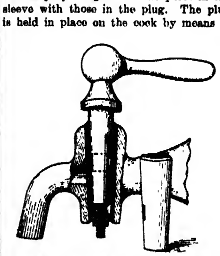
This device does not interfere with the backing of the engine, and in turning, it describes a circle only four feet greater in radius than the front wheels. In attaching the guide to the engine, the steering chains are detached from the front axle and connected up with the cables on the steering device, which, in turn, are held in alignment by two cable guides. The guide wheel may be offset any desired distance, the amount depending upon the number of plows and the size of the bottoms used. When the end of the field is reached the turning is done in the usual way by the steering wheel of the tractor.



The steering wheel of the tractor is in front of the frame and runs in a previously turned furrow.

Plug Cock With Removable Sleeve

A PLUG cock or faucet is much more desirable than a compression cock or screw faucet because it is cheaper to produce and is quick acting; for a quarter turn or less of the lever of the plug cock will wholly shut off the flow, or open it to full flow, whereas with a compression cock, several turns are necessary. However, the objection to a plug cock is that they are not durable and are apt to leak. Furthermore, the repair of a plug cock is rather expensive. Trouble usually manifests itself in wear of the edges of the ports and the only way of repairing the damage is to replace the worn off plug with a new one. In order to reduce this item of expense and provide a ready means of repairing a worn off plug cock an inventor has recently designed a cock having a removable sleeve on the plug. When the ports through this sleeve become badly worn it is a simple matter to remove the plug from the cock and replace the worn sleeve with a new one. The details of the invention are shown in the accompanying cut. A key on the body of the plug fits a keyway in the sleeve and insures proper register of the ports in the sleeve with those in the plug. The plug is held in place on the cock by means of a nut bearing against a split-ring washer, not shown in our engraving.



Plug cock with removable sleeve.

An Improved Ship Construction

ON June 11th, 1912, there was issued a patent, No. 1,029,546, to Joseph William Isherwood of Middlesbrough, England, which, it is claimed, will revolutionize the building of vessels. The invention relates largely to the framework of the vessel and seeks to so distribute the metal of the framework of a ship as to cause the skin and deck plating of the ship to form an essential part of the bracing structure, making this said plating do work or resist strains which ordinarily would be resisted by the framework only.

From this, it is asserted that considering ships of equal strength and seaworthiness, of say three hundred feet long, it is found they can be built with about five hundred tons less metal than under the ordinary construction, effecting a saving in cost of say thirty thousand dollars. The particular method of construction consists in making the transverse frames and beams a plurality of times stronger and spacing them a plurality of times farther apart than has heretofore been customary in the same type of vessel, and also in making said frames and beams of a less total weight in metal than has heretofore been customary. The particular feature upon which patentability rests seems to consist in the discovery that the complex twisting, racking and breaking strains to which a ship is subjected in a seaway, and which defy calcula-

tion, will be efficiently resisted by this particular disposition and saving of metal.

Although it has only been, say, about three years or a little over since the first vessel went to sea under this system, yet to-day it is claimed there have been built or are now building over two hundred large vessels using the method, aggregating in cost upward of sixty millions of dollars. Also that a very large number of vessels has been built or are now being built in the United States under this system and that only recently the navy has had completed two colliers constructed according to this invention.

The Trade-mark as a Business Asset

By W. E. Woodward

[*THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.*

The following is the seventh of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

The Elements of a Good Trade Mark—VII.

(*Continued from page 143, August 17th, 1912.*)

The reader who has perused the preceding articles devoted to a discussion of what a trade-mark cannot be, begins to wonder, perhaps, what part of the language is left unrestricted. It is true that the number of restrictions imposed by the law and the courts is considerable, but the language is virtually inexhaustible, with its infinite possible combination of letters and words. And to these possibilities of construction must be added the limitless varieties of designs and symbols which are registrable and valid under the law.

A trade-mark may be:

A coined word, like *Calox, Coca-Cola, Omo, Jap-a-Lac, Crisco, Pebeco, Celluloid, Pleao* (a trade-mark for suspenders; also for a toilet preparation), *Sapolio, Cravenette, Jell-O, Kodak, Uneeda, Pro-phy-lac-tic, Crex*, and *Quixo*; a symbol (like the Baker chocolate girl), the Prudential Insurance Company's trade-mark (which consists of a picture of the Rock of Gibraltar), the Merrimack duckling, the spear of Spearmint chewing gum, the Puritan painter (used on Bay State brick and cement coating), the Ford automobile mark (consisting of a winged pyramid), or the representation of a mask or domino (used on packages of Crystal Domino sugar), or the painter boy of the National Lead Company; a combination of word or words and a symbol (like Thomas A. Edison's portrait and signature, used in connection with phonograph), a picture of a black cat and the words "Black Cat" used as a hosiery trade-mark), the trade-mark of the Vacuum Oil Company (consisting of a picture of a gargoyle, in connection with the word "Gargoyle"), or a representation of a swan, accompanied by the word "Swan" (used on fountain pens); a portrait (like Mennen's Talcum Powder mark, which is a picture of Gerhard Mennen), or the portrait of Robert Burns (used on cigars); a word, or words used in a fanciful, non-descriptive sense (like "Cat's Paw," a trade-mark for rubber heels), "Bachelor's Friend" (a suggestive trade-mark for hosiery), the word "Ribbon" (a mark for a tooth-paste), "Republic" (used on automobile tires), "Velvet" (a trade-mark for smoking tobacco), "Onyx" (the trade-mark of a well-known brand of hosiery), "Ivory" (which stands for a famous brand of soap), "Diamond" (a name for tires), "Arrow" (used on collars), "Blue Jay" (a trade-mark for a corn plaster), "Big Ben" (used on alarm clocks), "Lifebuoy" (the name of a soap), or "Occident" (the name of a flour); an historical or a mythological character like Juno, King William, Stonewall Jackson, Cupid, Venus (a lead-pencil trade-mark), Samson (applied suggestively to a brand of rope), or Apollo (the name of a piano-player); initials or arbitrary numbers (like the "G. E." trade-mark of the General Electric Company), the number "4711" (applied to perfumery and toilet articles), "61" (a floor varnish), "O. K." (the name of a clip to hold papers together), "B. V. D." (the trade-mark of a well-known line of underwear), or the big "H" inclosed in a diamond-shaped design (used as a trade-mark on Heisey's glassware); the business name, of person, firm or corporation when written, printed, impressed, or woven in a distinctive manner, or in association with a portrait, or in an autographic form, as, for example, the name "Gillette," inclosed in a diamond and crossed by an arrow.

Marks that may be technically defective are registrable under the ten years' clause if they have been in exclusive use by the applicant for ten years preceding 1905. The word "Faultless," registered by E. Rosenfeld & Co., of Baltimore, as a trade-mark for garments, belongs to this class. "Faultless" is, of course, descriptive, but it is nevertheless registrable under the ten years' clause. Another mark of the same kind consists of the word "Coward"—a trade-mark for shoes. Coward is the proprietor, and under the act of 1905 his name has no eligibility as a trade-mark unless it is written or printed in a distinctive manner. But his name has been used as a trade-mark since 1868, and, consequently, falls within the provisions of the ten years' clause.

It is easy enough to devise a trade-mark that will comply with the letter and the spirit of the law. But a trade-mark should be something more than merely registrable and protectable. Think of the immense advertising and selling effort that must be brought to bear to overcome the inertia of a meaningless or unsuitable trade-mark.

A proposed trade-mark should not be adopted until every one of the following questions can be answered affirmatively in regard to it:

1. Is it easy to speak?
2. Is it easy to remember?
3. Is it easy to spell?
4. Is it simple in design?
5. Is it attractive in sound and appearance?
6. Is it suggestive of the good qualities of the merchandise?
7. Is it different from other trade-marks of the same class?
8. Can it be affixed to the goods with which it is to be used?
9. Is it registrable and protectable?

Competent trade-mark experts never submit a proposed trade-mark until it has passed this rigorous examination successfully. Few trade-marks in commercial use can stand these tests because most marks have been designed without any clear perspective of the part they were to play in business.

As a matter of interest and instruction, let us take several well-known trade-marks, at random, and put them through the list of test questions.

Opening a current magazine, the first trade-mark we see is "Postum," the name of a substitute for coffee. Postum is easy to say and remember and spell. It is simple, but not particularly attractive in sound. It has no suggestiveness, except the artificial suggestiveness of familiarity. It is distinctive, registrable and is virtually infringement-proof. If the figure 100 should be set down as denoting a perfect trade-mark, then Postum should be graded at about 80. It wholly lacks suggestiveness, and it is neither attractive nor displeasing.

The next mark that attracts our attention in this magazine is "Siwelclo," a coined word, applied to a flushing device used in connection with bathroom toilets. Siwelclo is not easy to pronounce; it is not euphonious; it is not easy to remember or to spell. It is the reverse of attractive in sound, and it carries no suggestiveness. It is registrable and protectable.

The next trade-mark is "O. K.," applied to paper fasteners. This mark possesses every good feature. It is suggestive in the sense that "O. K." means, in ordinary speech, "all right," "satisfactory," "good." These fasteners are used in offices. The symbol "O. K." has a distinct meaning in commercial language. We are of the opinion that "O. K." used as a trade-mark for office supplies, should be graded 100.

"Cat's Paw," a trade-mark for rubber heels, is the next. It is an example of a word that is suggestive in the wrong way. "Cat's Paw" suggests the soft quiet tread of a cat—and of rubber heels. At first glance it would seem that "Cat's Paw" is an ideal name. But those who sell rubber heels say that the noiseless tread (or "sneaky walk" as one shoemaker stated it) is the greatest of all drawbacks to the sale of rubber heels. In short, the name is suggestive, but suggests a defect.

Next we come to "Ralloc," which is the trade-mark of a collar retainer. The word is obviously the word "Collar" spelled backward. It is not euphonious or attractive, or distinctive in any way. This mark is an example of a large class of trade-marks which bear upon them the evidences of only one purpose—and that is, to produce something which will not be rejected by the Patent Office.

"Crex" is an excellent trade-mark. It is an adaptation of the word "Carex," the botanical name of a sedge-like grass which may be woven into a fabric. Dropping the "a" we have "Crex." This name sticks in the memory; it is easy to spell, easy to say, and is quite distinctive. It lacks inherent suggestiveness, but it is the kind of word that may be readily popularized by advertising.

There is a toilet preparation widely advertised and sold under the name "Sempre Giovine," meaning "always young." This trade-mark must be a tremendous drawback to the success of the article with which it is associated. It cannot be pronounced properly except by those who have taken lessons; and it is difficult to remember. To an English-speaking person it conveys no suggestion. Foreign words should be avoided in devising trade-marks. People do not like to ask for things by names which they cannot pronounce.

The trade-mark affixed to the linens sold by McCutcheon, of New York, a store famous for the quality of its fabrics, consists of the picture of an old-fashioned spinning wheel, without wording. This is a very good trade-mark. It brings up a mental picture of the slowly-wrought hand-woven linens of our grandmothers' time, fabrics that looked good and wore well.

There are trade-marks so admirably adapted to their purpose that they seem to be the work of a genius. "Uneeda"—applied to crackers in a sealed package, is such a trade-mark. "Rainbow," a trade-mark for dyes is another happy inspiration. This name makes one think of the fine colors and delicate tones of a rainbow. It stimulates the idea that these dyes emulate a rainbow in beauty. "Skidoo"—a trade-mark used in connection with a small gasoline engine for launches—is another trade-mark that touches the top notch of merit. It suggests agility and lightness, and the ability to get in motion and scurry away.

(*To be continued.*)

Notes for Inventors

Shortening a Moving Picture Film.—Patent No. 1,032,172 to Ernesto Zollinger of Turin, Italy, discloses an improvement in producing and projecting moving pictures wherein he deforms the picture on the film by reducing one of its dimensions to a fraction thereof and then projects the deformed picture through a deformer to reconstruct the projection to its normal proportions. Thus he can shorten up the picture in producing it and when he comes to project the picture on the screen he can lengthen it by suitable means to bring it back into condition to properly represent the subject he seeks to produce.

A Man Who Throws Ball to Himself.—Fred H. Wood of Elgin, N. D., has patented No. 1,030,558, a ball returning device which includes a curved tubular casing into the lower end of which a ball may be thrown, the upper end of the casing being returned slightly and a deflector plate being adjustably disposed with reference to the upper discharge end of the chute so its position can be varied in order to regulate the angle at which the ball is projected from the discharge opening.

A Domestic Dough Kneader.—In our issue of July 13th we published a brief note to the effect that somebody ought to invent a domestic dough kneader. A subscriber informs us that such an apparatus is already on the market. It consists of a twenty-quart pail having a bearing for a crank mounted on its top and a depending mixer attached to the crank. This mixer is a pointed finger, curved about one half of an arch, its lower end being about one half an inch from the bottom of the pail. We are assured that such kneaders can be obtained in almost any hardware dealer's store.

A Home-made Fly Catcher.—In one of our markets the small wholesalers have provided home-made fly catchers on a large scale. On a base board is mounted a length of fly screen-wire secured at its ends and sides to the board and elevated at the middle so the bait, usually fish heads, can be placed below the elevated portion. At one end the base wire inclines upwardly forming an entrance platform and a cover wire overlies the base one, and forms with it a chamber in which the trapped flies accumulate. The trap is simple and yet effective and attracts considerable attention in view of the campaign against the fly nuisance.

Brick Laying by Machine.—In a recent patent there is provided a machine for building up walls from superposed courses of brick with the interposition of mortar or cement between the bricks of the courses as well as between the courses. The machine has a rotatable brick carrier upon which the bricks are automatically gripped during a portion of the revolution of the carrier and from which the bricks are released when the carrier has conveyed the brick to its final position. The patent, No. 1,033,954, has been granted to Max George Shindler and Linus Paul Shindler of Hamburg, Germany.

Reducing the Noise on Street Curves.—Recently in Washington city a lady secured a judgment against a street railroad company for damage to her dress by the heavy oil used to lubricate a track curve to reduce wear and eliminate the scream-like noise when a car rounded the curve. As a result, the company stopped oiling the curve and the noise at times is almost intolerable. Some means, possibly mechanical, may be devised to overcome the friction between the wheel flange and curved rail and thus dispose of the noise nuisance and also avoid the excessive wear of wheel and rail.

A Mechanical Bow for Stringed Instruments.—A patent, No. 1,034,293, has been granted to Joseph von Pechl of Vienna, Austria, for a mechanical bowing device in which there is a movable carrier provided with rollers and a bow band traverses the the rollers and forms, with the carrier, a complete bow. Pedals are arranged for shifting the bow transversely of the strings as well as for controlling the pressure of the bow band upon the strings in order to secure the desired results.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

SHIRT -H SALTZMAN, 435 Jerome Ave, Brooklyn, N Y This improvement is in shirts provided with a plurality of lapels attached to the body adjacent the waist line thereof, to enable the shirt to be attached to the trousers and support them, thus allowing the wearer to dispense with suspenders The shirt is made strong throughout so that it will not be readily torn in use

Pertaining to Aviation.

FLYING MACHINE —R L BERNARD, Mountain View Cal This invention combines the main features of an aeroplane and a helicopter whereby certain advantages are attained in respect to starting and alighting, direction of flight, poising, maintenance of equilibrium regulation of speed, and general safety It is applicable to both monoplanes and biplanes

Electrical Devices.

ELECTRIC MOTOR E S. WETMORE, College Springs, Iowa The motor devised by this inventor has a ratchet wheel and an electromagnet and armature, pawls on the armature engage the ratchet teeth which are part of the circuit, and the relative movements of the parts make and break the circuit

ELECTROLYTIC CELL —A TOMMASINI, 3418 Independence Ave Kansas City, Mo The object in view is to provide an arrangement of means for passing a current of electricity through a solution containing water in such a manner that the hydrogen bubbles created thereby will be directed to one point of discharge, and the oxygen bubbles will be directed to another point of discharge.

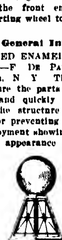
Of Interest to Farmers.

PORTABLE ORCHARD HEATER —M B FITTS, Minneapolis, Kan This invention generates steam and discharges the same along with hot air and heated products of combustion for any desired purpose, but it is particularly adapted for use as an orchard heater, that is to say, for preventing injury by low temperature to fruit and other trees, also to plants and vegetables

BINDER TRUCK —H J DRAGER, R. R, No 1, Orlando, Okla This truck is for attachment to a grain binder, for drawing the latter over the field or for transporting the binder from place to place. For this purpose the truck frame is arranged at its rear end for pivotal connection with the binder, and on the front end is pivoted a tongue and an evener, and in the rear of the front end is arranged a swiveled supporting wheel to support the truck frame

Of General Interest.

ILLUMINATED ENAMELED METAL BARBER'S POLE —F DE PALMA, 236 Central Ave, Brooklyn, N Y This invention provides a structure the parts whereof are readily combined and quickly renewed; provides for securing the structure in position, provides means for preventing wear or waste incident to employment showing on the structure to impair the appearance thereof, and provides access to the interior of the pole When the post or sign is employed as shown in the illustration as a sidewalk sign the base above the sidewalk is raised and the same is lifted away from the corroding influence of water held on the sidewalk



ILLUMINATED ENAMELED METAL BARBER'S POLE

WOVEN FABRIC - WILLIAM G TRAITVETTES, Paterson, N J The invention provides a fabric having interwoven bias or diagonal threads to reinforce the fabric and render it strong, durable and capable of withstanding strains in any direction For this result the fabric is formed of interwoven ground warp threads bias warp threads and weft threads, of which the bias warp threads extend diagonally across the fabric from one selvage to the other.

APPARATUS FOR DISTILLATION.—P. J. MATTINGLY, T. J. HINES, and J. J. BRENNAN, care of J Seligman, Kenyon Bldg., Louisville, Ky This invention has for an object to procure a more refined distillate by removing from the product all congeners which are of low grade and which are volatile only at higher temperatures, thereby producing a more refined product.

PROCESS OR METHOD OF MANUFACTURING ENVELOPS OR BAGS.—A. WASMUS, 16 Wolchonka, Moscow, Russia. The subject matter of this invention is a process or method of manufacturing envelops or bags, particularly those having threads for opening them, which consists in the flaps being folded around a tightly tensioned thread serving as an abutment.

NON-REFILLABLE BOTTLE. E. J. HEIL, Carteret, N J The purpose here is to provide a non-refillable bottle with a member having an annular groove in which is disposed a resilient catch, the terminals of which extend into a recess in the neck of the bottle, to prevent the removal of the member after the member has been pushed into position.

WAGON GATE.—W HOPPER, Jefferson, Iowa. This invention refers particularly to gates for wagons which are used for hauling and storing grain Their bodies often have to be hoisted to deliver the load of grain carried thereby into bins and other compartments formed inside structures where grain is stored; and this invention comprises means for readily operating these wagon gates after the same have been lifted to permit grain to be discharged therefrom

Hardware and Tools.

SWIVEL JOINT —F. G. HAYES, 31 Ohio St, Sharon, Pa This joint is for use on devices where it is desired to revolve the device or a portion thereof, the said revolving movement being substantially controlled by the operator To obtain this, use is made of a body provided with a cap, and means on the body for revolving the same

SUSPENDING DEVICE FOR STORM WINDOWS AND LIKE STRUCTURES.—J. M. IIJERMSTAD, Red Wing, Minn This invention is intended more particularly for use in connection with storm windows, screens, etc., such as are removably swung by their upper ends so as to admit of being fastened in vertical position in a window or door opening, or swung on their supporting means to a position inclining to the opening.

Heating and Lighting.

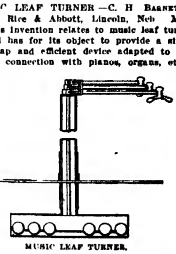
DRIER —J. C. COGBURN, Marietta, Ga Mr. Cogburn's invention relates in general to a drier, and more particularly to that class of driers known as "hot air driers" The invention supplies a continuous current of hot air directly to separate drying compartments; withdraws saturated air from each compartment by means of a fan attachment, and regulates the admission of unsaturated air to the device

INCINERATOR FOR GARBAGE, ETC.—L. MATTHEWS, Paris, Tenn A series of compartments is adopted to receive pans holding material to be incinerated and with a series of grates corresponding with the compartments, one or all of which may be used at a time, the arrangements being such that fumes from the material being incinerated and the products of combustion from the fire-boxes are directed into a common exit flue

Machines and Mechanical Devices.

AUTOMATIC SHUT OFF CONDUIT —ISABELLA GILLEN, Rockaway Beach, New York, N Y This invention is an automatic shut-off for conduits, such as gas and water pipes, and is designed to operate a valve to close said pipe in case of fire, to prevent the contents of the pipe or conduit from escaping in case the pipes inside of the house or building communicating with the conduit should be broken or damaged.

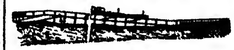
MUSIC LEAF TURNER —C. H BARNETT, care of Rice & Abbott, Lincoln, Neb Mr. Barnett's invention relates to music leaf turners, and has for its object to provide a simple, cheap and efficient device adapted to be used in connection with pianos, organs, etc., for readily and quickly turning either forward or backward the leaves of sheet music or music books The entire device can be packed in a small space, indeed, the shelf may be entirely removed from the standard and the entire device put in a receptacle large enough simply to receive the base. The illustration pictures a front elevation of the device.



MUSIC LEAF TURNER.

PADDLE MECHANISM FOR VESSELS.—W. H. WITTE, Charles St. Ave., Homewood, Baltimore, Md. This invention provides mechanism for propulsion in shallow streams; provides means for reversing, arresting and suspending the operation of the paddles of the mechanism to operate at various depths or to suspend the propulsive operation without stopping the machinery; and provides a means for preventing the inflow of water through the joints of the paddle box.

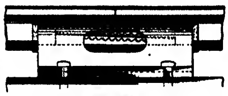
WATER LIFT.—B. F. STRANGE, 1.—R. F. D., Victor, Mont. This invention is especially adapted for elevating water to the uplands for irrigation and other useful purposes. It provides a mechanism for lifting water continuously from a lower level to a higher one especially adapted for use in irrigation. The flume or ditch may be of any desired construction, the size and length depending on the country in which the outfit is used. The operation of the car and the pusher may be continued for any desired length of time, and as many cars may be employed as can be taken care of, the operation affording a continuous supply of water to the upper level. The engraving shows a sectional side view of the water source and means of elevation to distribution points.



WATER LIFT FOR IRRIGATING.

Railways and Their Accessories.

RAIL JOINT.—C. W. YEBBURY, 528 W. William St., Springfield, Ill. This invention relates generally to a rail and more particularly to a fish plate, adapted for use on steam, electric and elevated roads, or in mines or quarries, or any place where a construction is required to hold rails together for tractive service. The invention provides means for holding adjacent ends of meeting rails, arranged so that bolts or equivalent devices are not necessary. Further, a structure is provided which by reason of the arrangement of the parts is well adapted to hold the meeting ends of adjacent rails in position and insulated from the roadbed, thereby facilitating operation and maintenance of signal systems, which make use of the rails as parts of the circuit. A side view of the invention in operative position is herewith shown.



RAIL JOINT.

PNEUMATIC POWER PAINTING MACHINE.—F. DYKES and D. E. WALLS, Milliken, N. Y This hand-guided, power-rotated brush delivers and spreads paint upon a prepared surface; it controls the supply of paint; and spreads the paint in the delivery thereof to the surface to avoid lumping or streaking of the finished product. Controlling devices for the brush manually control the quantity of paint and the spread thereof.

CONVERTER VALVE.—P. E. GANNON, P. O. Box 94, Jerome, Ariz. This invention relates to valves utilized in connection with the wind boxes of converters, particularly copper converters, which are adapted to permit of the insertion of a rod therethrough, such rod being extended through the tuyere for the purpose of preventing the latter from clogging while impurities are being blown out of the copper

ADDING MACHINE.—J. W. WITSELL, 37-39 Haynes St., Charleston, S. C In this instance the invention is an improvement in adding machines, and has for its object the provision of a simple and easily operated device of the character specified, of a size which permits it to be placed conveniently on the desk near the user, and which has few parts to get out of order.

WELL PACKING.—E. G. BOUTTE, St. Martinville, La., care of Bennett Oil Co., Opelousas, La. This invention is an improvement in packings, and has for its object the provision of a device especially adapted for deep wells, designed to be operated by a cable or the like, and adapted also to act as a seal for the well when required.

ATTACHMENT FOR SEWING MACHINES.—H. L. LAMB, 1409 Tremont St., Nashville, Tenn. The object here is to provide means adapted to be attached to the stabbing device of harness sewing machines, for channeling the leather in advance of the stitching mechanism, to provide a channel or groove for receiving and hiding the thread or stitch.

Pertaining to Vehicles.

PNEUMATIC WHEEL.—A. H. SMITH, Topton, Pa. The parts of this device being assembled and the annular cushion being inflated, the weight of the axle and parts carried thereby rests directly upon the inner surface of the pneumatic cushion and is thence transferred to the tire. The edge of the disk carried by the axle being loose relatively to the plates, is free to move relative to them and to the tire, the limit of movement being the degree of compression which the annular cushion can undergo. The cushion is not a tire in the true sense of the word, and as it is protected on all sides it can be made much thinner than tires are usually made. The engraving represents a cross section of one half of the wheel.

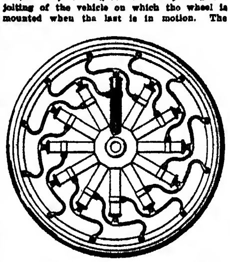
PNEUMATIC WHEEL.

ICE BREAKER.—J. L. OPP, Pinckneyville, Ill. This invention relates to devices for breaking ice from a cake, so as to serve a piece of any desired size and cause it to split on a substantially straight line. It is particularly adapted for embodiment in an attachment for ice wagons, but may be employed in connection with any suitable supporting frame at an ice plant, or the like.

VEHICLE WHEEL.—C. W. BARRETT, 158 Martin Ave., San Jose, Cal. The invention refers to wheels for use with automobiles and other purposes, and has reference more particularly to a wheel comprising a hub, a pneumatic cushion surrounding the hub, a felly, spokes connecting the cushion and the felly, and a solid cushion member within the pneumatic cushion.

VEHICLE WHEEL.—A. MCKILLOP, Alleghany, Cal. The inventor provides a resilient wheel which has the benefits of the ordinary pneumatic wheel, but in which the pneumatic member is not exposed to the wear of the ordinary pneumatic tire. The wheel has a series of pneumatic cushions disposed about the hub in such a manner as to take up shocks.

SPRING WHEEL.—A. W. DRUMMOND, Ap't. 56, Barker Block, Berkley, Cal. The rim is resiliently mounted with respect to spokes and hub, the object being to eliminate jarring and jolting of the vehicle on which the wheel is mounted when the last is in motion. The invention comprises a hub having a plurality of tubular spokes in which spring-actuated plungers are mounted, the plungers being pivotally connected at their outer ends each to a leaf spring connected at one end to the rim of the wheel and at the other end to the body of a spoke adjacent the spoke at which each plunger is mounted. A side elevation of the wheel is shown herewith partly in section.



SPRING WHEEL TO ELIMINATE JARRING.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12672) G. A. B. asks: If one pours hot water into a glass it often breaks, while if one puts a spoon in the glass first it seldom does break. Can you tell me why this is? What is the effect of the spoon in or on the glass that should save it? What is the scientific principle? A. The reason usually given why a glass does not break when hot water is poured into it, if a silver spoon be in the glass, is that the spoon serves as a conductor of the heat, and so the glass does not receive so severe a shock from the heat as it would otherwise. Silver is the best conductor of heat known, and therefore takes heat more quickly than any other material.

(12673) S. G. says: 1. Why is perpetual motion impossible? A. Perpetual motion is impossible because of the equality of cause and effect. The effect is never greater than its cause. There is no frictionless machine, and force is always required to overcome inertia in a machine whose parts have any weight. This being the case, some of the power imparted to a machine must be used in imparting motion to the machine itself, and in keeping it in motion. The rest of the power appears in useful work. This is always but a fraction of the total power imparted to the machine. No machine can, therefore, in any way generate enough power to turn itself and do useful work. It cannot even generate power enough to keep itself in motion continuously. 2. Does the law of gravity interfere with perpetual motion? A. The law of gravity is silent in regard to perpetual motion. It only specifies the manner in which matter attracts all other matter in the universe. It is simply a statement of a universal fact. 3. Has anyone reached the point of defying gravity? A. Anyone may defy gravity if he is strong enough. Every time you rise from a chair or climb a ladder you defy gravity. Aviation is a grand defiance of gravity. But if you mean that a man should rise without putting forth any exertion, and remain poised without support or effort, then our answer must be that no one has or ever will defy gravity, so long as attraction exists between the particles of matter. The constitution of the universe must be changed and become totally different from what it is at present for that to be done.

(12674) R. M. asks: Within the past few years we have had some very severe electrical storms, and my daughter's house has been struck twice by the lightning. We have been wondering why it should strike this particular house both times. It stands high and is 70 feet away from any other house. We do not think this the reason, because lightning strikes houses in valleys just the same. There is an attic over the entire house which is not plastered, and having a slate roof, the heat is intense. This attic is not used, as it can be reached only by a ladder. There are three windows in it, but of course it is not ventilated very often, and we have come to the conclusion that this hot, foul air attracted the lightning. We have broken a small pane of glass in each window, but this does not seem to help much. Have been thinking of putting a ventilator in one window. This would cause a current of air. If this is placed in the one window, would it be all right to have the small panes out of the other two? Would you advise placing shutters instead of the three windows? A. The matter of protection from lightning is a very perplexing one. It is certain that the old proverb, "Lightning never strikes twice in the same place," is not true. Some localities are more liable to be struck than others. The character of the soil seems to affect the liability to be struck. A recent writer makes the liability as follows: "If the liability for chalk formation is 1, then it is 2 for marl, 7 for clay, 9 for sand, 22 for loam." Some kinds of trees are more liable than others to be struck. In a study covering 45,000 acres in a German forest, it was found that oaks were struck 159 times; beeches, 21 times; pines, 20 times; firs, 59 times; birches, 4 times; larches, 7 times; and ashes, 5 times. The proportion of the different kinds of trees in the forest was: Beech, 70 per cent; oak, 11 per cent; pine, 13 per cent; fir, 16 per cent. These facts may assist you in judging whether the locality has anything to do with the frequency of the lightning strokes. As to the heat of the air in the attic, we have never heard of this as a cause of lightning striking, but it is best to ventilate the attic for its influence upon the health of the family in the dwelling. We should take the windows out on all the sides possible, and keep the rain out by a lattice blind during the hot weather, replacing the sash when cold weather comes on; but we should provide for ventilation all the year around. Some have thought that a current of hot air rising with the smoke from a chimney would aid to determine the path of a lightning discharge. This may be true. In such a situation as you describe, we should have good lightning rods placed upon the house. To go into this matter in detail is quite beyond the limit of a letter, and we would suggest that you ask the assistance of the weather observer at the station in your city. The Bureau in Washington has published much valuable advice on the installing of lightning rods, and they will be able to place this at your disposal at a very moderate cost. Fortunately, there are relatively few fatalities to human beings from lightning as compared with the large number of lightning flashes.

NEW BOOKS, ETC.

Physiography for High Schools. By Albert L. Arey, C.E., Frank L. Bryant, B.S., William W. Clendenin, M.S., M.A., and William T. Morrey, A.M. New York: D. C. Heath & Co., 1912. 8vo.; 450 pp.; illustrated. Price, $1.25.

Taking first the earth as a planet, and then dealing with its air, its sea, and its land, the collaborators in this text-book endeavor to impart to high school pupils a rounded knowledge of physiography. A great deal of care is evident in the selection and arrangement of material. That deemed advisable of omission from a first-year course is so indicated by being set in smaller type. Technical terms are italicised when first used, so that they may be the more readily mastered and defined by the student. The questions following each chapter require the use of the reasoning powers and the drawing of inferences, rather than a mere parrot-memory of the chapter material.

Sanford's Manual of Color. By John Ithiel Sanford. New York: Mrs. J. I. Sanford, 150 Fifth Avenue. 8vo.; 33 pp.; illustrated. Price, $1.

Rightly holding that the harmony of color should be recognized as quite as important to the eye as harmony of sound is to the ear, Mr. Sanford gives us a primer of the laws governing color and combinations of color, a primer that might be used to advantage not by artists and colorists alone, but by all who desire to dress tastefully and to have their home surroundings harmonious and pleasing. It is true that the writer forces us to relinquish that magic word "vibgyor," so lavishly made use of by the school textbooks of fifteen or twenty years ago, for violet is classed as diluted purple and indigo is discarded as being a combination of black and blue and hence impossible of inclusion among the prismatic colors. But the destruction of a few cherished beliefs should not blind us to the merits of the little primer, which gives within thirty-three pages a wealth of sound instruction and demonstration. Two color charts serve to make clear the rules and definitions, the "hexagon color guide," showing in a particularly simple way the relation of primary, secondary, tertiary, and intermediate colors.

Some Chemical Problems of To-day. By Robert Kennedy Duncan. New York: Harper & Brothers, 1911. 254 pp.; illustrated.

A rather forbidding title, this, for a collection of most interesting essays. One would imagine that the book was intended for the specialist, did not the author's name give a clue to the nature of the work, for Prof. Robert Kennedy Duncan is well known as one of the most entertaining of writers of real science for non-technical readers. Two of the chapters in the present work take the reader to the very extremes of chemical exploration, from the investigation of particles so small that millions of them together would barely be visible to the naked eye, to the study of enormous incandescent masses, so distant that the largest of telescopes fails sensibly to magnify them above a geometric point of light. From veriest childhood one has associated with the word "chemistry" a process of division by which eventually an individual molecule could be arrived at, a particle so small that it could not be further divided without surprising changes in its characteristic properties. The diameter was expressed by a decimal consisting mainly of a long string of zeros—whether a dozen or two dozen one could not quite remember. What was the use of burdening the mind with a theory? But those vague rows of ciphers now have a real meaning. The microscope, which at best could not detect an object smaller than one-seven thousandth of a millimeter in diameter, has been cast aside for the ultra-microscope, which enables one to see particles so infinitesimally small that if they are not actually molecules they certainly approach very closely to molecular dimensions. Better still, an apparatus has been devised for actually counting the myriads of atoms in a given quantity of helium. All of this is recounted in a most fascinating chapter on "The Question of the Atom."

From this point the reader is taken to the antipodes, where he finds the chemist collaborating with the astronomer in developing a new theory of the solar system and analyzing the constituents of a nebula countless millions of miles away, almost as if he had it in a test tube in his own laboratory.

Other frontier posts are visited in the chapters on the "Whitherward of Matter" and the "Chemical Interpretation of Life," and the reader is given a glimpse of two of the most fascinating phases of chemical research. The rest of the book pertains chiefly to problems of industrial chemistry: revolutionizing of the camphor industry; developments in bread-making, the relation between chemistry and manufacture in America, and the work of the industrial fellowships at the universities of Kansas and Pittsburgh.

The book as a whole is somewhat disconnected being largely made up of articles previously published in magazines, but each chapter is a complete story in itself, charmingly written in the author's familiar style.

My Three Big Flights. By André Beaumont (Lieut. J. Conneau). McBridge, Nast & Co., New York: 156 pp.; illustrated.

Lieutenant J. Conneau, who assumed the name of Beaumont for aviation purposes, and won fame as a result of his remarkable performances in the now historic races, "Paris to Rome," the "European Circuit," and the "British Circuit," has written a most readable and entertaining book on his experiences. Lieutenant Conneau, unlike most aviators, is a man of scientific training and therefore admirably qualified to guide a machine through the air. Unquestionably his success is partly to be attributed to his skill in navigating. Lieutenant Conneau has written in a very light vein, and makes no pretense to giving much technical information. But even as it is, there are glimpses here and there of the difficulties that must be coped with in handling a monoplane.

Internal Combustion Engine Manual. By F. W. Sterling, Lieutenant U. S. Navy. Annapolis, Maryland: School of Marine Engineering, U. S. Naval Academy, 1911. 8vo.; 146 pp.; illustrated.

The manual is intended as a textbook for the use of midshipmen, but there is no reason why other students should not profit by the well-arranged data here offered. Fuel being the fundamental that controls design and operation, this subject is first presented. After considering fuel, ignition, cooling, and lubrication in their relation to the engine, these four operations are shown combined in some of the latest and most approved types of engine. The producer plant is given a chapter to itself. For so short a course, the subject has been treated in a very sensible and satisfactory manner.

Studies in Terrestrial Magnetism. By C. Chree, M.A., F.R.S. New York: The Macmillan Company, 1912. 8vo.; 201 pp. Price, $1.50 net.

The "Studies" present Prof. Chree's original researches in certain branches of terrestrial magnetism, and the work makes no claim to being a complete text-book of its subject, or a summary of existing knowledge. Among other papers of interest may be mentioned those on secular and non-cyclic changes, on diurnal inequalities, on Antarctic magnetic results, and on comparisons of Arctic and Antarctic disturbances. It is suggested that more rapid progress might be made if educational institutions, equipped with the necessary instruments, would co-operate in a general plan of systematic observations. The invention of a more accurate and efficient magnetograph, free from "drift," is greatly to be desired. The author believes that it may become possible to differentiate between various types of sunspots, and thus to attain to a perception of some definite relationship between sunspots and magnetic storms, toward the existence of which relationship it is at present advisable to maintain an open mind.

Baseballogy. By Edmund Vance Cooke. Chicago: Forbes & Co., 1912. 16mo.; 88 pp. Price, 50 cents.

These rhymes of baseball deal most adequately with "Fan's taste, fan's talk, fan's dope, fan's everything." "Afflatus" is quite shamelessly rhymed with "tomatoes," "bucolic" with "base-ball-ic," and under such dignified captions as "Metempsychosis" and "Evolution" appears some of the most atrocious slang ever heard about the diamond. The verve and vim of Edmund Vance Cooke's well-known style pervades every stanza, and fans—especially those sufficiently educated to appreciate references to Socrates, Titian, and Achilles—will find many a chuckle in this timely epic of the national game.

False Modesty. By E. B. Lowry, M.D. Chicago: Forbes & Co., 1912. 16mo.; 110 pp. Price, 50 cents.

"False Modesty" is a little volume of instruction by the author of "Truths" and "Confidences." Its appeal is particularly directed to parents, teachers, and physicians, and calls for the wider dissemination, in pure form, of the knowledge necessary to save the young from the various pitfalls which ignorance of sexual laws places beneath their feet. Some appalling facts are made known, and it is the writer's belief that the country is as debased, in proportion to its population, as the city. Instruction in motherhood is urged as a partial solution of the problem. In a final chapter on "Coming Educational Reform," facts all too little known alternate with clearly-phrased advice and instruction of prime importance to the men and women of to-morrow. The need of education in the laws of sex and in sexual hygiene is characterized as the greatest need of American civilization.

Cutting It Out. By Samuel G. Blythe. Chicago: Forbes & Co., 1912. 16mo.; 60 pp. Price, 35 cents.

The Fun of Getting Thin. By Samuel G. Blythe. Chicago: Forbes & Co., 1912. 16mo.; 68 pp. Price, 35 cents.

In "Cutting It Out," "it" refers to the use of intoxicants. As the cutting out of intoxicants was also a feature of "The Fun of Getting Thin," it would seem that Mr. Blythe might have informed the public in one volume, at one and the same time, how to refrain from liquor and how to reduce flesh. In each case from thirty to fifty pages are taken up in talking about the author's indifference as to whether anybody follows his advice or not, while the actual plans offered may be summarized in six words. However, had the little books been limited to essentials, we should have lost many pages of dry humor and sensible philosophy; then, too, it is probable that, written in this serio-comic vein, the little homilies will reach and convince good fellows who would never dream of attending a temperance lecture or reading a book on diet.

Allgemeine Vererbungslehre. Von Prof. Dr. Valentin Haecker. Zweite Vermehrte Auflage. Mit einem Titelbilde, 133 Figuren im Text und 4 farbigen Tafeln. XII, 405 S. gr. 8 vo. 1912 M–10–, in Leinenband MII,–. Braunschweig: Verlag von Freidr. Vieweg & Sohn.

This book presents to the biologist, the physician, and the animal breeder results that have been obtained after twenty-five years' of investigation by students of heredity. The book is essentially practical in character, for, although the author seeks to trace back to the protoplasmic cell those inheritable differences which are the object of the eugenist's study, he devotes much space to the application of recent discoveries to humanity, to animal breeding, and to plant breeding. This is the second edition of the work, a fact which speaks eloquently for the favor with which it has met in Germany.

Handbuch für Heer und Flotte. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant z. D. Unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Vollständig in 108 Lieferungen reichillustrierten Textes mit farbigen Beilagen, Karten, Planen, Gefechtsskizzen usw. Leipzig: Richard Bong & Co., 1912.

Installments 41 to 44 of the Handbook for Army and Navy treat the subject from *Maximilian I to Napoleon I*. Among the articles that should be particularly mentioned are those on the extra-European Colonial Wars (1500 to 1648), the wars of the Swedes, Prussians, and Poles for the possession of the Baltic provinces, and the Thirty Years' War. This last subject is discussed on the basis of entirely new investigations. Most interesting is Dr. Koser's essay on the Wars of Frederick the Great. General Count Schlieffen has discussed admirably the Napoleonic campaign of 1806-1807. There are twenty-five excellent war maps on which may be found every geographical name mentioned in these installments.

The Evolution of Animal Intelligence. By S. J. Holmes. New York: Henry Holt & Co., 1911. 296 pp.

In this book the reader will find summarized in a very popular and interesting way the main results of recent psychological and chemical study of animals. Loeb's work on tropisms is commented upon at considerable length, as it deserves to be, since it is a serious attempt to explain by chemical action alone movements hitherto rather vaguely ascribed to "instinct." On the psychology of animals the author has dwelt at considerable length, particularly on the work done more recently by such investigators as Thorndike. About one half of the book is devoted to an explanation of the more or less automatic movements of the lower organisms, and the other half to the subject of intelligence itself. An excellent feature of the book is the bibliography appended to each chapter.

Heredity in Relation to Eugenics. By Charles Benedict Davenport. New York: Henry Holt & Co., 1911. With 175 illustrations and diagrams, and complete bibliography and index. 8vo.; 298 pp. Price, $2.

Dr. Davenport may be regarded as the leading exponent in this country of the science of eugenics. He has done able work, as the head of the Cold Spring Harbor Station, in rousing the public conscience to the subject of human heredity. The discussion of such cases as that of the famous Jukes family in America and the Zero family in Switzerland has unquestionably served to drive home the consequences of a too promiscuous mating of the socially unfit. Although it is much too early to pass any legislation which would have for its object the purging of the bad blood now in human society, books such as this on human heredity perform the useful service of keeping the subject before the public and of indicating how far science has progressed toward the solution of a problem which is nothing more or less than the preservation of the human race.

Dr. Davenport is a strict Mendelian. Although like most eugenists he acknowledges the merit of the early work done by Galton, the biometric method evidently has no attraction for him. Because it deals with groups rather than with individuals, the biometric can hardly lead to a definite solution of the eugenic problem. The Mendelian method, to which this book is largely devoted, has the distinct advantage of enabling one to determine with certainty how certain tendencies are transmitted. It is known accurately how such physical and mental defects as *dementia praecox*, Huntington's chorea, deaf mutism, etc., are inherited. The effort which Dr. Davenport has made to carry the investigation further, for example, to the inheritance of specific diseases (rheumatism, skin diseases, and diseases of the blood), while not wholly successful, as he himself admits, nevertheless indicates the wonderful possibilities which lie dormant in the method, if we only could gather sufficient facts and accurate family histories.

The New Serum Treatment of Bleeding and Hemorrhage

By Dr. Leonard Keene Hirshberg, A.B., M.A., M.D. (Johns Hopkins).

THAT the injection of fresh blood serum is a potent factor in controlling certain types of hemorrhage where there is a delay in the clotting of the blood, has been reported by a great number of scientific investigators.

The treatment of hemorrhage depends upon two factors: First, the use of drugs for their action on the blood vessels; secondly, agents used to promote the clotting of the blood itself. Many different kinds of drugs, whose value depends upon regulating the tension of the blood vessel have been used Among them are the salts of calcium, strontium, magnesium, and solutions of gelatin.

In 1910, an investigation of the causes of twelve cases of hemophilia, which is a certain type of disease with continuous hemorrhages, were published. The coagulation or clotting of the blood was long delayed, in all of these cases and in those patients who showed the most marked symptoms, clotting or coagulation required an hour or more.

Two forms of hemophilia were discovered, the accidental or transitory, and the congenital variety which appeared at birth. In the former the blood was thin and flowed rapidly through a needle inserted into a vein. In the latter, the blood was found to be sticky and it flowed slowly, very much like molasses. Experiments with blood were carried on, showing that if three drops of animal blood serum were added to three cubic centimeters of blood in either class of patients, the coagulation of blood took place promptly and hemorrhages ceased. They also discovered that the same effect could be produced by internal injections of the blood serum. The serum of a man, rabbit, horse, or ox was all found to effect a quick clotting of blood, previously conductive to hemorrhage. The value of this finding is appreciated, when it is realized that bleeders or "hæmophilics" are as common as club feet.

The serum was injected into a patient before the extraction of a tooth, and during an operation upon an abscess, and it successfully prevented every vestige of hemorrhage. As one doctor says: "Fresh serum is an effective remedy for the arrest of hemorrhage in all cases of blood disease. It is more effective than any previously discovered method to prevent general bleeding"

In applying the use of the serum, large doses must be employed, and that while any serum may be used, that of the ox or goat should, if possible, be avoided, since it has the power to produce toxic symptoms of a serious nature The use of injections of animal blood, to prevent hemorrhage is permitted only in cases of real bleeders disease called "hemophilia." Many failures were reported due to attempts to apply blood serum to other diseases

An eminent scientist at work on this problem says that an injection of fresh serum is the most efficient means we have for the treatment of hemophilia, but if it is not at hand, regular antitoxic serum, whether diphtheria or lockjaw antitoxins, may be employed, and answers just as well.

There is a case of a boy of fourteen years who always had hemorrhages from the nose and gums which failed to respond to the treatment of injections of gelatin solution, but which stopped when injections of diphtheria antitoxin were applied. There is another case of a newly-born infant who had hemorrhages from the mouth and nose. The infant was treated by applying sponges dipped in horse serum, which rapidly controlled the bleeding.

Here is a typical case of hemophilia. A child, who was in a very poor condition as the result of a steady loss of blood following the extraction of a molar tooth, was treated by the application of astringent medicines, but they proved absolutely useless, so it was decided to try the administration of serum. Normal horse serum was injected, and after a few minutes the oozing blood became less and less and the bleeding stopped. There was a recurrence and relapse, however, and another injection of horse serum was given the following day. At once the hemorrhage ceased and did not reappear any more.

A striking report of the use of serum in treatment of hemophilia is afforded by a New York pathologist. He injected normal human serum in the treatment of nine babies. He believes that all of these babies would have died under any other treatment.

The following conclusions have been obtained by different workers:

1. The coagulation period in hemophilic subjects or "bleeders" is greatly shortened by the injection of fresh serum.

2. The local application of fresh serum in wounds, in patients in whom there is a delayed coagulation of the blood, acts as a preventive of hemorrhage.

3. The serum of any living animal species is efficient in producing this phenomenon of clotting.

4. The sera of the ox and dog should be avoided if possible, because of the toxic symptoms frequently attending their use.

5. Regular tetanus and diphtheria antitoxic sera are less satisfactory than freshly drawn material, but do very well in an emergency.

The difference between antitoxic and fresh sera may be due either to age or to the presence of the preservative drugs, which the former always contain. The reports that antitoxic sera have been effective in some cases and disappointing in others is due to the fact that age or drugs act as a retardant to clotting. The inactivity of the sera probably depends upon the changes which they undergo with age.

The belief that the action of animal or human serum in increasing the coagulation of blood in hemophilic subjects depends upon the substitution of an active clotting agent is, therefore, based upon the following facts:

The rapidity and completeness of coagulation is directly proportional to the amount of this complicated clotting agent found in the serum that is introduced. This agent is called "thrombin," and is about the same as the pepsin in the stomach.

Experience shows that relatively large amounts of serum must be employed to produce definite results. That is to say, to stop bleeding in anyone, it is essential that large quantities of new blood serum be introduced into the veins of the one who is suffering the hemorrhage. It is worse than useless to give a little serum: a great deal or none at all must be given.

To Dr. Alexis Carrell, Prof. William H. Howell, and Dr. Crile, all young American scientists, the public are indebted for discoveries that have lead up to this great new method of life-saving. With antiseptics, antitoxins, anæsthetics, aeroplanes, spectrum analysis, radium, X-ray, wireless telegraphy, telephones, the Panama Canal, and synthetic chemistry, the serum treatment of hemorrhage and bleeding, will be soon placed among the modern wonders of the world.

Can the Baser Metals Be Changed to Gold?

THE newer scientific contributions from the physical, chemical, and electrical laboratories, work from discovered and confirmed facts to widely applied theories. This is in marked contrast to the science of the schoolmen and the ancients, who ponder deeply in a high attic, evolve some kind of a theory, and then discover only such facts as conform to their pet theory.

This difference is much more marked than the man in the street is willing to admit. It is a contrast that many boast-

ful "self-made" men do not see. The investigations of radio-activity and electrons, have proved beyond cavil that the elements are not immutable. They are essentially all alike at bottom, and are made by an evolutionary process.

It is known to every high school student that the element radium, spontaneously disintegrates into two other elements; one a heavy, inactive gas called niton, and a lighter gas called helium. In turn, after niton has emanated from radium, it changes into helium and a solid element, until recently called radium A. Radium A also undergoes disintegration into other elements, and so on *ad infinitum*. Each one of these breaking down experiments sets free enormous quantities of energy; enough, in fact, to make electricity for a large city. It has been carefully calculated by Sir William Ramsay and his co-workers that the decomposition of one cubic centimeter—about a thimbleful—of niton, is accompanied by the evolution of some four million times as much heat as is obtained by burning an equal amount of gas.

It is thus clearly apparent that as each element and its atoms disintegrate, they unlock and liberate a reservoir of potential energy so immense that the finite mind of man cannot grasp it. Once this vast effort of nature is realized, it will begin to be faintly understood, how much power will be necessary to generate the excessively high potential requisite, to change or transmute one metal element into another; base tin into virgin gold, as the alchemists attempted. The only energy of this sort available is that given out with the natural breaking up of niton and the other radio-active elements; and even then because of the long periods required, the slowness of the change, the transmutation even if possible, only infinitesimally small particles of elements would ever be transmuted.

Sir William Ramsay recently performed certain experiments in this direction on distilled water and niton. Mr. Cameron assisted him in this work. Distilled water, upon which a very small amount of niton gas was allowed to act, was placed in a silica glass tube. Then the gases which resulted were removed, and examined with a spectroscope. Hydrogen, oxygen, helium, neon, and niton were found. They concluded from these experiments that the transformation of niton into neon in the presence of distilled water as indisputably proved, and, if a transmutation be defined as a transformation brought about at will, by change of conditions, "then this is the first case of transmutation of which conclusive evidence is put forward," Dr. Ramsay writes.

Sir William Ramsay and Mr. Cameron no longer maintain in the face of Madame Curie's disproof, that lithium can be transmuted from copper. The work of Sir William Ramsay with Mr. Usher on the action of niton upon solutions of lead, thorium, titanium and silicon, where carbon was always previously excluded, showed the presence of carbon dioxide every time. Chlorate of bismuth and zirconium solutions, showed carbonic acid gas also when acted on by niton.

But in no case so far discovered, was an element obtained by such transformations that were heavier than the elements from which they came. No experiment has yet been successfully carried out by Sir William Ramsay or by any other physicist, in which an element became changed into one of higher atomic weight. Even criticism of such transmutations as have been obtained, were made. Rutherford held that the neon and argon found, might have come from the glass or leakage, but the quantities reported certainly disprove any such possibility.

Loath as we have been to give a place in modern chemistry to the doctrine of transmutation of elements, little as we care to seriously consider attic theories, dogmas dear to the hearts of the advocates, near-new philosophy, or chemical divining rods, none of us can deny these established, laboratory facts, repeatedly confirmed by unbiased experimenters.

Hence, the volatile imaginings of that vapory crew of pseudo-chemists of the

Middle Ages, although founded upon vain dreams and their illogical yearning for a philosopher's stone and an elixir of life, the modern physicists now stand sponsors to the ghostly nothings of medieval alchemy.

The Aeroplane in the Military Maneuvers

(*Concluded from page 156.*)

above a height of 2,000 feet. If the barograph showed that they had dipped below this level they would be counted out, having been theoretically shot. German regulations place the safety zone above 2,800 feet, and French regulations above 3,000 feet. Considering the fact that the men had to use both hands for the control of their machines, and, therefore, could not employ field glasses to study the country beneath them, the reports they turned in were marvelous in detail and accuracy. Lieut. Foulois, for instance, in his reconnaissance of August 18th, left camp at 3.58 A. M. and returned to camp at 10.28 A. M. The report he brought back covered two typewritten pages, and gave the location of thirteen different military bodies. All the time he was making tests with his aeroplane wireless set. No actual messages were sent, but various letter signals were transmitted, for the purpose of attuning the instrument. Lieut. Milling also brought back a very complete report, which was even more detailed than that of Lieut. Foulois, for the reason that he was not handicapped by attention to a wireless telegraph instrument With his high speed machine he made the circuit in a little over an hour and brought back detailed information that would have taken half a day for an entire brigade of mounted scouts to have collected As yet the relative accuracy of the report obtained by mounted scouts and those obtained by aeroplane scouts have not been made public. However, the chief umpire knowing the exact position of every detachment was able at once to confirm the accuracy of the aeroplane reports.

The officers have expressed themselves as highly pleased with the work of the aviation squadron. It must be borne in mind that the country over which these operations have been conducted is the most difficult flying country imaginable. There is no level ground anywhere. It is so cut up with valleys and gorges that the air fairly boils with unexpected gusts of wind

Although Mr. Haven is an accomplished and daring aviator, his work so far, as a scout has been very disappointing. While the other scouts have brought back two-page typewritten reports, he has been able to discover practically nothing of value. It has been urged that the United States Army does not need to go to the expense of establishing an aviation squadron for the reason that there are so many experienced aviators in this country who could be hired in time of war to do the scouting for the army, and if they were unable to report any information themselves, they could at least carry a passenger with them. The present maneuvers show that the carrying of passengers is by no means feasible under all conditions, and unless the aviator is able to make a detailed report, the army is likely to suffer from lack of important information.

While the aviation squadron has done splendid work under the peculiar conditions encountered, nevertheless the fact has been clearly demonstrated that what the army requires is a well trained corps of aviator scouts with machines not necessarily of high speed, but certainly of large carrying capacity, which will be capable of rising from the ground under the most adverse conditions. It is quite essential that a machine carry a passenger because it is impossible for a man to pilot a machine and keep track of all that is passing beneath him, trusting to his memory largely with only an occasional opportunity to reach over and jot down a few words of memorandum.

If this branch of the service can be fully developed, it will no doubt result in great economy, for it will make it unneces-

sary to employ mounted scouts, thus leaving the cavalry free for fighting purposes only. Of course in these maneuvers the aeroplanes have had no enemy in the air to contend with. During the first half of the maneuvers, that is, in the instructional period, the aviation squadron was neutral. After that the machines were divided between the two armies. They were perfectly safe from attack as long as they kept above the danger zone, but in time of war no doubt they would have to contend with aerial sharpshooters.

The work of the wireless set on board Lieut. Foulois's machine was purely experimental, and nothing much was done. The instruments he used were selected and installed by himself on the machine. A small generator capable of developing 250 watts was driven by friction gearing from the flywheel of the engine. He used the wire bracing of the aeroplane for a counterpoise, and for his antenna he employed a suspended copper wire 300 feet long. This he paid off from the machine gradually after he had reached a sufficient elevation. His sending key was attached to one of the operating levers. The only one available was that on the left hand side, and it was necessary for him to send his signals by operating the key with his left thumb. This was exceedingly awkward, and the signals he sent were certainly not of the best. Nevertheless, they were clearly picked up by the wireless station at headquarters, even when the aeroplane was over twelve miles away. When landing, Lieut. Foulois clipped the wire before it had come within reach of trees or other obstruction on the land. The release of the antenna was effected very accurately, and it always dropped within a prescribed area, so that it was readily recovered.

Antagonistic Body Juices

THE substance produced by the "suprarenal capsules," small bodies lying just above the kidneys, plays an important part in the workings of the higher organisms, since death quickly follows the removal of these bodies. At the same time, the exact function of the substance is not known. If a small quantity of the adrenalin, or extract from one of these capsules is injected into the blood, there is a quick rise in the blood-pressure. This is brought about by the contraction of the muscles of the smaller arteries. The effect lasts but a few minutes, however, and at the end of that time it is quite impossible to discover a trace of the adrenalin in any part of the blood. What becomes of the adrenalin in that short time is a complete mystery.

Many poisons and other foreign substances are destroyed or neutralized directly by the blood, but that is not the case with adrenalin. If a small quantity of the substance is mixed with blood and the mixture is allowed to stand, the adrenalin may still be discovered the next day. Neither is it destroyed by any sera.

Within a very short time, however, Dr. S. J. Meltzer of the Rockefeller Institute has discovered that there is a body fluid capable of destroying adrenalin. Dr. Meltzer had an opportunity to obtain quantities of spinal fluid from a number of patients suffering from various diseases. In all cases the adrenalin was destroyed by the spinal fluid within an hour, if kept at the temperature of the blood. If the mixture of the two fluids was kept in an ice-box, however, the adrenalin was just as active at the end of a long time as it was when first prepared. One part of the adrenalin was mixed with twenty parts of spinal fluid, and one half cubic centimeter was used as a test, the effect of the mixture upon blood-pressure in a frog being an indication of the activity of the adrenalin. If the mixture is kept warm, even four times the normal dose produces no effect at the end of an hour.

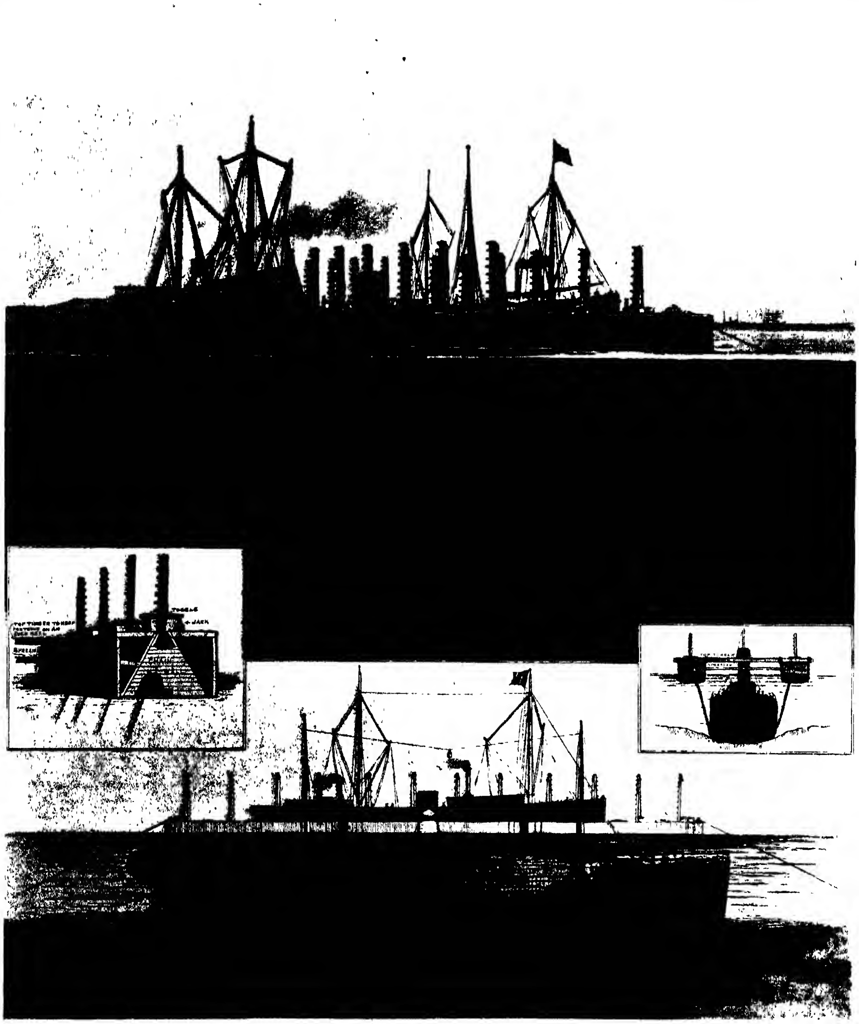
In some diseases the spinal fluid is much more active as a destroyer of the adrenalin than in others. Thus the spinal fluid from a patient suffering from infantile paralysis is quicker in its action than the spinal fluid from one having tubercular meningitis. This fact may turn out to be of great practical importance, in the opinion of experts.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 9. | NEW YORK, AUGUST 31, 1912 | 10 CENTS A COPY $3.00 A YEAR



Method of raising a sunken vessel by passing chains under it and securing them to pontoons.

SALVING THE STEAMER "JOSE."—[See page 178.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, AUGUST 31, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary and Treasurer; all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter. Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico Cuba and Panama	
Subscriptions for Foreign Countries one year, postage prepaid,	4.50
Subscriptions for Canada one year postage prepaid, . . .	3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year,	$3.00
Scientific American Supplement (established 1876) . "	5.00
American Homes and Gardens . . . . . . "	3.00

The combined subscription rates and rates to foreign countries including Canada will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Relative Sea Strength of the United States

ACCORDING to the latest estimate made by our admirable Office of Naval Intelligence of the Navy Department, the United States has already yielded the position of second in naval strength among the navies of the world to Germany. This is true, even if we take into consideration the battleships already built, and it is startlingly true, when we consider both the battleships built and those under construction. At the present time Great Britain possesses fourteen battleships of the dreadnought type, Germany eight, and the United States seven. Great Britain has eleven such ships under construction, Germany nine and the United States five only. In battleships of the pre-dreadnought type, such as the "Connecticut," "Georgia" and "Maine," Great Britain possesses forty-one, Germany twenty-one and the United States twenty-five, which gives us a superiority of five ships of this class over Germany. The pre-dreadnought battleships, however, because of their inferiority in speed and gun power will be at a great disadvantage when they come to lie in line of battle against the modern ten- and twelve-gun dreadnoughts. Even on a basis of the total tonnage of all ships completed, Germany still has a decided lead over the United States. Great Britain heads the list with 1,888,414 tons, followed by Germany with 787,709 tons, the United States with 758,491 tons, France with 619,512 tons, and Japan with 438,087 tons.

When we come to consider the vessels which are now under construction, the great activity of Germany and the comparative inactivity of this country produce a marked difference in the comparison. If all vessels now building were completed, Great Britain would lead with 2,469,678 tons, Germany would be second with 1,140,238 tons, and the United States would be third with 914,744 tons, France would come next with 804,211 tons, and Japan fifth with 617,083 tons. Of dreadnought battleships and battle cruisers combined, Great Britain would possess thirty-six, Germany, twenty five, and the United States, twelve only—less than one half the strength of Germany, and just one third the dreadnought strength of Great Britain.

In the presence of these figures, it is simply bewildering to attempt to understand the attitude of the House of Representatives in its attempt to prohibit the construction of more battleships. In one single week Congress has seen fit to reaffirm the Monroe Doctrine and to repudiate the pledges of a treaty, the ink of whose signatories is scarcely yet dry. Statesmanship of this kind can scarcely be called pacific. If it is the policy of Congress to tear up treaties and cry "hands off" from the only promising field remaining for colonial exploitation, this policy should surely be backed up with those armed forces which are necessary to render it successful. We believe there never was a time when the United States so greatly needed a strong navy as she does at this critical stage of her progress toward her ultimate dominant position among the world powers.

America's Need for an Aerotechnical Institute

THE inventors and builders of air craft in this country feel keenly the want of experimental data to form a rational basis for their structural designs; the users and students of air craft experience an equal want of adequate and disinterested comparative tests of existing craft, appliances and accessories. There is, therefore, a general desire for an American aeronautical institute that shall meet these wants in the broadest and most thorough manner, an institute not for training aviators or instructing engineers, for this is already done in several places, but primarily for producing and disseminating aeronautical science.

In European countries some excellent laboratories for aeronautical research are privately endowed and conducted in the interest of civil science and construction; others having governmental support are intended primarily to subserve a military purpose and may not be readily available, if at all, for civilian use. The latter kind are, at present, not strongly demanded in this country, either by the army or the navy. Hence, if a federal appropriation for the advancement of aeronautical science be made at all, it should be alloted to one of the civil establishments, such as the Bureau of Standards, or the Smithsonian Institution. The latter can receive both private endowments and federal grants, has sufficient building space, an aeronautical library and the old Langley workshops, not to mention the Hodgkins fund of $100,000 for studies of the atmosphere.

If an aeronautical institute were privately founded it should have an endowment equal at least in purchasing power to the best in Europe, say twenty to thirty thousand dollars a year; its directorate should include representative men alert to the needs of aero science and industry; it should be practically independent in its finances and government, or if affiliated with a great seat of learning, should not be dominated by the president or teaching corps, or in any sense made a dependent of, or mere adjunct to, some scientific department.

Whether established by private means or governmental, or both, what our people require is a representative American institution "in which a staff of trained specialists, provided with adequate apparatus, shall furnish physical constants, laws, formulæ, and empirical data of substantial and permanent value to the engineer, the inventor, the manufacturer, whose energies should remain free to employ such knowledge to the advancement of important industrial arts; a laboratory where complete and reliable tests and reports shall be made upon all classes of actual air craft that may be worthy of study and development; an institution surrounded by ample maneuvering space of land and water, and preferably adjacent to a governmental flying ground, available with hangars and shops, to all civilians worthy of assistance; a center of scientific and practical activity, where at all times may be witnessed the most accurate researches and most exhaustive tests; where the knowledge so gained shall be disseminated by publications, by oral communications, by exhibitions of apparatus and instruments, of materials and models, by photographs and drawings, in a word, by all the facilities of the aerodrome, the show room, the library, and the assembly room."

The foundation of a national institute so comprehensive and thoroughgoing would greatly promote a direct and universal mode of locomotion, and would constitute a monument fit to bear the name of the most munificent patron of science. But unless an individual will endow such an institution adequately to meet all requirements for many years, it will be better for the votaries of aeronautics to initiate an establishment comprising such buildings and endowment fund that it shall be capable of ample growth by the cumulative contributions of many individuals or associations, and by occasional grants from the federal government. Better no aerotechnical institute than one too meagerly furnished with men or resources to meet the practical needs of the community and to make substantial contributions to the science in which America once enjoyed leadership.

Hon. W. G. Sharp, in an able appeal to the House of Representatives for the encouragement of aviation, recommended an appropriation for an aeronautical laboratory, and the Aero Club of America has, with the indorsement of prominent scientific bodies, pledged itself to secure the endowment of such an establishment. The SCIENTIFIC AMERICAN commends the movement most heartily.

The Possibility of the Oil Engine

THE internal combustion gasoline engine is being developed as much in the United States as elsewhere, and the Junkers oil engine, the most recent challenge of the reciprocating heat motor, may be expected to have a great career on this side of the Atlantic. Occasional oil engines in electric central station service—Diesel engines—are already reported, and any class of engine room attendant can operate them successfully.

For marine propulsion also, who knows but the staunch ships that will some day be launched to revive the ancient glory of the American merchant marine will be equipped with oil engines. Our own fuels and those of Europe and Asia [illegible] vessels, with the great oil fields of other parts of the globe to fall back upon, including the vast supply in Borneo. Oil is the coming fuel for propelling vessels. It is cheap, it saves space and weight, it requires a smaller crew, and it is incomparably preferable to coal in point of cleanliness. Roughly speaking, in the oil engine one ton of oil equals 3½ tons of coal, the economy being higher as the size of the engine is increased. In order to compete with oil, coal must be obtainable at thirty-nine cents per ton. As a power auxiliary for sailing craft the new engine should find a great field where steam has not had a very extensive application owing to the inconvenience of rigging a temporary funnel, the long time required to get up steam in an emergency, and the valuable cargo space taken up by the coal bunkers and the boiler. The oil engine, on the other hand, is always ready for instant use, no funnel is required, the space taken from the cargo capacity is but a small part of the whole, and the oil fuel can be stowed where it would be impracticable to carry coal. While these advantages are shared by the gasoline auxiliary, the new oil engine leads in the far lower cost of its fuel, in the extreme simplicity of the engine, seldom necessitating repairs or overhauling, the absence of any ignition mechanism, differential or reverse gear, and the excellent cooling system.

The Needs of the Bureau of Chemistry

WHAT shall be said of the powerful division chiefs in the Bureau of Chemistry, who, charged with safeguarding the health of ninety million people, fail to gather scientific evidence of a character that would enable the courts to bring dishonest food manufacturers, criminal dispensers of injurious beverages, and adulterers of healing drugs to book? And what shall be said of a government that permits a Bigelow, a Kebler and a Doolittle to squander public money in worthless analyses and to bring actions that any open-minded lawyer must know are futile? Only the press can rouse the public to a sense of the grave risks incurred by the maladministration of the Pure Food and Drugs Act for which these three men are largely responsible; but the public press knows nothing of science and publishes nothing but praise of the inept officials who control the Bureau of Chemistry.

The organization of the Bureau is in part responsible for a situation which has made scientific work almost impossible. At present those who are charged with the investigation of food and drug products are subject to the authority of Bigelow and Kebler, of officials, in a word, in whose hands mainly lies the fate of the Food and Drugs Act. What could be more admirable? Is not this the practice of every manufacturing establishment? It so happens, however, that the Bureau is not a department store, where such a system might operate well, but a scientific institution, intrusted with highly important investigations that concern every man, woman and child of the ninety million people who constitute the population of this country. And it so happens that the division chiefs or their agents prosecute manufacturers for violations of the Pure Food and Drugs Act, not as scientific men, absolutely sure of their facts, but as district attorneys. Like district attorneys, they care only for the game of prosecuting, and measure their efficiency rather by the number of actions brought than by the character of their scientific work.

Under the present system the subjects for investigation are assigned to subordinate officials by the very division chiefs who are eventually to prosecute manufacturers guilty of fraud. The success of the division chiefs in court depends on the scientific findings of those who are assigned to the cases. If the division chiefs were men of any scientific standing, men who cared only for the scientific facts, the system might still be effective. But, caring chiefly for prosecutions and little for scientific truth, it can be imagined how little they care for research. The public is vitally interested in the proper enforcement of the Pure Food and Drugs Act, and consequently in the scientific investigations of the Bureau of Chemistry.

Waste in Paper-making.—Chemists attribute the great rise in the price of all sorts of paper in recent years largely to wasteful methods of manufacture, which for the most part the mills care little or nothing about checking. One well-known chemist said the other day: "Some years ago I made a contract, after much trouble, with a large paper mill. The first thing I did when I went to work was to collect samples of all their waste waters and determine the amount, proportion and kind of material that was going into the stream. This mill had never paid, though it was well located. One reason for their failure to pay a dividend, I found, was that 17 per cent of the product was floating off down the river. I told the manager about it. Well, he paid my salary for a year, and never allowed me to come into the mill again."

Electricity

German Regulation of Wireless Telegraphy at Sea.—The new official regulations, requiring all German passenger steamers carrying a minimum of 75 persons, including the crew, to be equipped with wireless telegraph apparatus of a transmitting radius of 100 nautical miles, will go into effect on October 1st.

Heating Churches by Electricity.—Owing to the large amount of water-power in Switzerland, electricity can be applied to a good advantage and a low cost, for heating buildings, and it is stated that it is also being used in a number of instances for the heating of churches. Among these are the churches of Walfhalden, Schwellbrunn, Arosa, Sils, Brugg, Aengst and others.

Sweden's Hydro-electric Development in 1911.—The newly-erected hydraulic plants in Sweden for the last year amount to nearly 40,000 horse-power, and to this is to be added the extension made in the former plants during the year, which makes a total increase of 67,667 horse-power as against 62,385 for the preceding year. These figures relate to electric power plants installed by private companies. The height of the fall which is used here varies up to 240 feet, and in general it is under 80 feet.

A Large Electric Plant in Brazil.—A company has recently been formed for the purpose of constructing an electric power plant in Brazil which will be one of the largest in South America. The hydraulic station is to be located on the San Francisco River and the power will come from the Alphonso falls. It is stated in the French technical journals that the size of the plant during the initial period of operation will be about 200,000 horse-power, but at a later date the station may be extended so as to produce as much as 1,300,000 horse-power.

Pekin's Telephone System.—The telephone service of Pekin has been commenced by the installing of two central exchanges which are laid out for a total of 6,400 subscribers. There are about 3,000 subscribers in the Chinese and the Tartar quarters, and the remaining quarters are to be wired up at a no very distant period. It is to be noted that the two exchanges are constructed by the government and are now being operated by it. The legations already had many private telephones, and these are now connected to the above exchanges.

Wireless Telegraphy From Balloons.—A German experimenter, H. Mosler, has devised a method of using wireless telegraphy upon spherical balloons. He places a wire around the balloon body so as to form a vertical loop, also a second wire hanging down from the basket. More recently he has found it best to attach the loop wire to a band of stout canvas and then to lay this around the balloon bag so as to attach the band to the network and avoid putting the wire directly upon it as this might cut into the balloon. It is much better to have the loop lying to one side and not directly over the center, so that the wires coming together into the basket are away from the gas valve and are less likely to cause a fire.

Electric Steel Production in Norway and Sweden.—In Norway and Sweden there is considerable activity at present in the way of electric steel production. There are two new steel works with electric furnaces shortly to be erected which propose to turn out 16,000 tons annually during the first period, and this will no doubt be increased later on. One of these enterprises is carried on by the Stavanger Steel Company, which is capitalized at $1,200,000, and it is now arranging to secure 2,500 horse-power in electric current from a local hydraulic plant. The new works will include an electric furnace of the most recent design for steel production, with a rolling mill, steam hammers and foundry for steel casting. It is expected to turn out annually 1,600 tons of rolled steel, 300 tons forged steel, 600 tons cast steel, and 700 tons diverse. The second enterprise consists of an electric steel plant near Arendal and it will use current from the Boilejos hydraulic plant.

The Electric Furnace and Ferro-silicon.—The electric furnace process can be used to a great advantage in obtaining compounds of iron and silicon or ferro-silicon, and it is even possible to produce pure silicon in this way. The usual blast furnace methods are said to give a maximum of only 20 per cent silicon in the compounds obtained, but much more is given by the electric process. Besides, the impurities such as calcium, manganese, carbon and others are much less than before. It is noticed that ferro-silicon containing less than 30 per cent or more than 65 per cent is stable, but products lying between 30 and 65 per cent are easily decomposed. From a chemical standpoint it is admitted that there are at least three different silicides of iron, and perhaps two others. The present process is now being operated in Europe and is covered by patents, the electric furnace somewhat resembling a calcium carbide furnace, but it is found that a large-sized furnace is essential to obtain the proper results. Such must also be operated near to the center of raw material, with good transport facilities for the finished products.

Science

Drinking Cups For Horses.—The New York Bureau of Municipal Research announces that hereafter individual drinking cups and shower baths are to be used. The Bureau points out that among the 90,000 horses that perish every year in Manhattan no less than 6,500 succumb to glanders which is communicated by filthy horse troughs.

The Death of Schleyer.—On August 20th there died at Constance, Baden, Johann M. Schleyer. In 1879 he invented Volapuk, an artificial language that was as much spoken about in its day as Esperanto is now. His Volapuk was the first artificial language that attained any measure of practical success. When the third Volapuk Congress was held in 1889 two hundred and eighty three societies had been formed in various parts of the world to spread its use.

Prof. Frost Receives a Degree from Cambridge.—Prof. Edwin B. Frost, the director of the Yerkes Observatory, while a delegate to the 250th anniversary of the Royal Society was given the honorary degree of D.Sc. from Cambridge University. Prof. Frost will spend the year abroad in England and Germany. In his absence, Prof. S. Alfred Mitchell will be at Yerkes Observatory, having been granted a Sabbatical year for that purpose by Columbia University. Prof. Mitchell is well known to our readers from his contributions to the SCIENTIFIC AMERICAN on astronomical subjects.

Barring Insects.—On August 10th the House of Representatives passed a bill introduced last May by Representative James S. Simmons of Niagara Falls, N. Y., regulating the importation of plant products Under this bill it will be unlawful for any person to import into the United States any nursery stock except under permit from the Secretary of Agriculture and under conditions and regulations prescribed by him. The United States is the only great power without protection from importation of insect-infested or diseased plant stock. Diseased livestock is excluded by law, but diseased plants, have as yet, not been barred

The Origin of Novæ.—In the monthly notices of The Royal Astronomical Society for June, 1912, Prof. E. E. Barnard of Yerkes observatory has a paper on "Micrometrical Measures and Focal Peculiarities of Nova Lacertæ (Espin)." In the course of his paper, Prof. Barnard objects to the theory that the outburst of a nova is due to a star colliding with a nebula. He points out that photography does not show that the novæ are in nebulous regions except in the case of Nova Andromedæ and "even here the spectroscope throws doubt on the nebulosity." Prof. Barnard believes that we are probably dealing with real motion caused by some force not yet known. "Indeed," he assures us, "I think this, like some of the abnormal phenomena of the comets reveals to us the effects of new forces (call them that if you like) as yet unknown to us, but which we must take into consideration, as our knowledge of the universe advances."

A Catalogue of More Than 100,000 Stars.—At the Harvard College Observatory the most extensive astronomical labor ever undertaken is now in progress. Up to the present time, the largest and most complete star catalogue in existence has been the Draper Catalogue, which indexes about 10,000 stars, with careful details concerning their spectra. This catalogue was compiled by Mrs. Williamina Paton Fleming at Harvard before 1891. Since that year, the increasing size of telescopes and improvements in stellar photography have so greatly increased the number of stars shown upon the photographic plates that an entirely new edition of the Draper Catalogue, enlarged, and giving the record of each star to recent years seemed imperative. Prof. Edward C. Pickering, Director of the Harvard Observatory, has contemplated such an edition for many months, and in October, 1911, the work was begun. Since Mrs. Fleming's death in May, 1911, Miss Annie J. Cannon has been appointed Curator of the Astronomical Photographs, succeeding Mrs. Fleming, and Miss Cannon is in charge of the catalogue work. She is directing its progress so ably that what several distinguished astronomers feared they might not live to see accomplished, will probably be completed within five years. She has organized the research into divisions and sections, each of which is conducted by one or other of her women assistants. A vast collection of stellar photographs, giving a complete record of the heavens during many years, is available at Harvard through the co-operation of its Cambridge and Arequipa stations, so that abounding material is furnished for the catalogue. The work represents an infinite series of mathematical calculations, preliminary card-cataloguing, notations, charting, etc., which depends upon the utmost care in studying and comparing photographic plates, identifying stars, and determining their degrees of brightness, qualities and classes of spectrum. For such work women, says Prof. Pickering, have proved their especial adaptability. About 5,000 stars each month are indexed on the cards.

Aeronautics

Aerial Fleet for the Argentine Navy.—The Sociedad Sportiva Argentina has made an offer to the Ministry of War, Gen. Gregorio Velez, of an aerial fleet, to be subscribed for by the public, for which purpose 1,500,000 illustrated post cards will be issued.

The Utility of Airships in the Treatment of Tuberculosis.—Dr. Flemming, a prominent medical authority, at a meeting of the Berlin Aeronautical Association, lectured on the beneficial effects of high altitudes on tuberculosis. He pointed out that 15 minutes' exposure to the sun's rays during an airship flight at high altitude meant certain death to the tuberculosis bacilli.

Recording Births in Aeroplane.—That the regulations and rules governing aerial travel will be modeled closely upon those in use on the sea is shown in the latest set proposed by the international committee. It provides among other things, that a death or birth occurring on an aeroplane or dirigible balloon in transit, must be reported by the pilot at the first landing place.

A French Hydro-aeroplane Contest.—The Automobile Club of France has organized a concourse of hydro-aeroplanes on the coast of Brittany and around the island of Jersey. This will be one of the most interesting events of the year in the way of sport and also from a technical standpoint. It has received the patronage of the Minister of the Marine who is to send a fleet of torpedo boats to accompany the flights as well as two battleships which will be stationed in the bay of St. Malo. The British Admirality is expected to co-operate in the movement. The Automobile Club awards $10,000 in prizes, and another prize is awarded by the island of Jersey for a race from St. Malo to the island and back.

The Michelin Cup.—This year the annual aeroplane race for the Michelin Cup representing a prize of $4,000 is to be a combined speed and touring event. On a given day the pilot is to cover three separate circuits laid out in the region of Paris, with the Buc grounds as a starting point. The first circuit is Buc, Rheims, Amiens, Rouen and return, and the total distance for the three circuits is 750 miles. Gasoline can only be taken on at the starting point, and the minimum speed is 36 miles an hour, but in fact it will take a speed of 75 miles an hour to succeed in the contest This means an 11 hours' flight with the needed stops, so that the daylight period of 15 or 16 hours will be nearly approached. At all events the flights are likely to bring out some high speeds.

French Hydro-aeroplane Experiments.—During the recent maneuvers of the French fleet in the Mediterranean, the war vessel "Foudre" was fitted out so as to carry hydro-aeroplanes on board This is easier to carry out than in the case of ordinary aeroplanes, as there is now no launching platform needed to start up the flyers. On the vessel, an overhead crane takes up the flyers as they leave the hangar and drops them overboard into the water The first Nieuport monoplane of this kind piloted by Ensign Delage showed quite a success. It is of the 3-place type and carries a 100 horse-power Gnome motor. On one occasion the aeroplane was let overboard even during rough water, and it made a number of flights above the assembled fleet. One part of the fleet represented the enemy in the maneuvers and the aeroplane could observe its position and bring back a very correct report Some of the flights with one passenger on board lasted for 3 hours at a time, flying above Toulon and the harbor and along the coast. Admiral Boué de Lapeyrère and his etat-major were much impressed with the performance of the hydro-aeroplanes on this occasion.

Aviators' Sickness.—Aside from the mountain sickness, due to the rarefaction of the air and the muscular work done by climbers, and also the balloon disease with analogous symptoms but which does not appear except at very high altitudes, we now have to take account of aeroplane or aviators' sickness, whose effects have already been spoken about. These are due to the rapidity with which the maximum height is reached and the still greater speed at the descent, that is, the passage from a low-air pressure to a higher one. M. Berget, a French aeronaut, after speaking of the conditions of the atmosphere in general, also brings out some points on this question. Aeroplanes sometimes reach altitudes of 10,000 feet in an hour, and here the effects on the ear such as humming or cracking noise are about the same as in a balloon, but the effect on the respiratory organs is different. The pilot is sooner out of breath and he feels a special kind of uneasiness During the descent, the heart beats are of greater amplitude, but without accelerating. A quick descent in a sailing flight at a speed of 1,000 or 1,200 feet a minute or even more, since Morane descended at Havre from 8,000 feet height in 6 minutes, causes a feeling of a special kind, or uneasiness, accompanied with humming in the ears. Burning in the face is also felt and a severe headache, also the great tendency to sleep which has been before observed. The movements of the body are sluggish and unskilful These symptoms continue for some time after the landing, and the tension in the arteries is noticed to be higher than the normal.

The Junkers Oil Engine

A New Type of Motor on the Diesel Principle

By Joseph B. Baker

PROF H. JUNKERS, of Aachen, Germany, has developed a remarkable internal combustion engine utilizing the combustion (not explosion) of cheap, low-grade liquid fuels by the compression-ignition method of the Diesel engine, but with certain radical improvements in design which give increased efficiency and adaptation to all power purposes

Just as Watt is the father of the steam engine in its manifold forms, so in our own day Dr. Diesel is recognized as the first worker in the field of the internal combustion engine burning cheap fuel. Now comes the Junkers engine as a radical improvement in this field. Existing engines utilizing cheap fuel oils to generate power at economies unattainable in the best compound steam engines, have left much to be desired for certain stationary and marine applications, and have been inapplicable to locomotive propulsion. The need has been for an engine which could generate cheap power from low-grade oils—down to even the asphaltum oils and their residues—not only for all stationary purposes, but for propelling vessels under practical conditions and for driving locomotives

This need is now filled in the Junkers oil engine (Fig 9), in which the combustion of the fuel charge in a single cylinder urges two pistons in opposite directions. The cylinder is a simple tube, open to the atmosphere at both ends—no cylinder heads, no stuffing-boxes, no valves with mechanism The greatly superior heat efficiency, high aggregate piston speeds with low speed of each separate piston, better scavenging and cooling and lower cooling losses, and the absence of valves enable this engine to show a marked reduction of weight per horse-power—down to less than one half, in some cases one quarter—and a decided increase in efficiency when underloaded and in overload capacity. The design allows higher speeds and also a greater range of control of speed Actual engines in use include the propelling equipment for twelve ocean-going vessels now under construction, stationary engines being manufactured by prominent European companies. At present a locomotive of 2,000 horse-power, designed for a speed of 125 kilometers per hour, and weighing less than a steam locomotive, is under construction. The field open to this type of prime mover is indicated by the fact that it consumes any cheap liquid fuel, even including asphaltum crude oils.

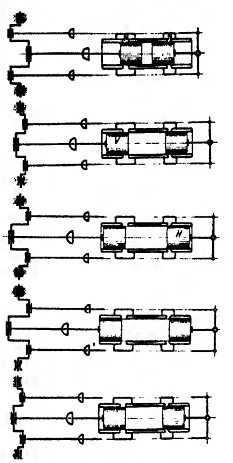
Without dwelling on technical details, the fundamental principle of operation of the Junkers oil engine may be understood by an inspection of the annexed schematic diagrams (Figs. 1 to 5) of a single cylinder engine—cylinder and pair of pistons, and the connecting rods and cranks of the engine in five successive positions throughout one revolution—in conjunction with the indicator card (Fig 6).

The arrangement of parts in the five diagrams is clear on first inspection in all but one feature. The obvious features are the open cylinder without cylinder heads, the two pistons moving alternately outward, that is away from each other, and inward or toward each other, the left-hand piston I, being connected directly to the middle one of three cranks and the right hand piston *H*, being connected to a cross head and a pair of parallel connecting rods to the two outer of these cranks 180 degrees from the middle crank, and the movement of the pistons, successively outward and inward, thus turning the main shaft The object of the ports *M* and *N* will be understood as the operation of the engine is traced through one complete revolution

The engine works on the two cycle principle. In Fig 1 the pistons are at the inner dead center, and the combustion space between them is filled with highly compressed, highly heated air as the result of the previous compression stroke In this position the oil fuel is injected in a finely dispersed condition, igniting and burning under constant pressure during the first part of the outstroke (from A to *B* on the indicator card, Fig. 6). With the supply of fuel cut off at *B*, the working stroke continues with expansion of the products of combustion from *B* to *C*, bringing the pistons to the position of Fig. 2 At this point piston I is just about to open the ring of exhaust ports *M*. As the outward motion of the pistons continues (*C* to *D* on the card) the spent gases escape at about atmospheric pressure, and the position of Fig 3 is reached, in which the exhaust ports are opening wider and piston *H* is just about to open a ring of air-ports *N*, allowing fresh air to enter and to scavenge the cylinder. These conditions are maintained until the pistons, having passed the outer dead center (Fig. 4) begin to come back on the return stroke. In Fig. 5 the inward movement of the pistons has closed both rings of the ports and the compression stroke begins on a cylinder full of cool, fresh air. The compression, *F* to A on the card, heats the confined air to such a temperature that the fuel, injected shortly before the point *A* is reached, ignites as it is sprayed into the cylinder.

The above is the complete cycle traced for a single cylinder engine of one pair of pistons. In the two-cylinder (four-piston) form, which may be built as a vertical or horizontal tandem engine with great simplicity of design, the two inner pistons move together and are linked to a single crosshead connected by a pair of rods to the two outside cranks, as shown in Fig. 7, which is a plan of the engine; the two outer pistons, which also move together, being linked by crossheads and rods to the middle crank at 180 degrees, as shown in Fig. 8, a side elevation. This construction, with two pair of connecting rods, in the horizontal and vertical planes, respectively, makes every stroke of the engine a working as well as a compression stroke.

It will be noted that the scavenging is thorough, and that both the exhaust and the former are accomplished without valves having moving parts. The compressed air for scavenging and for the fuel spray is supplied by auxiliaries driven from the connecting-rod linkage, which is extremely simple. The cylinders are simple castings, and one side of each piston is always exposed to the atmosphere and comes to rest at every outward stroke in a well-cooled region of the cylinder not touched by the products of combustion. This secures perfect cooling and lubrication. Finally, owing to the division of the total stroke between two pistons in each cylinder, a high piston speed is attained with low individual piston speeds, and a long cylinder of small diameter, most favorably adapted to thorough scavenging and to perfect combustion, may be used.



Figs. 1 to 5.—(Reading from top to bottom) diagrams showing operation of single-cylinder Junkers engine.

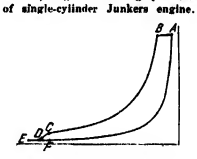


Fig. 6.—Typical indicator card.

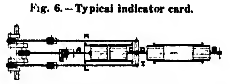


Fig. 7.—Elementary plan of two-cylinder horizontal tandem engine showing connecting-rod system for the two inner pistons operating on the side cranks.

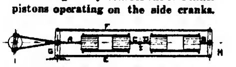


Fig. 8.—Elementary side elevation of two-cylinder engine showing connecting-rod system for the two outer pistons operating on the center crank.

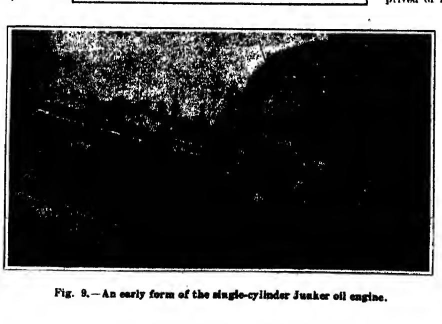


Fig. 9.—An early form of the single-cylinder Junker oil engine.

The Government Hunts Rats

THE United States Government is conducting a hunting expedition for rats and ground squirrels, which so far has cost it considerable money for every animal added to the kill. The expedition is in charge of the Public Health and Marine Hospital Service, which has spent $1,000,000 on the killing, and is continuing the expenditure to-day at the rate of $14,000 a month.

Rats and ground squirrels were picked out for the Government's game for the reason that they are held responsible for transmitting the bubonic plague which broke out on the Pacific coast in 1907, and so effectively has the hunting been carried on that not since 1909 has a single human being in that section of the country been affected with the disease.

In connection with its work of extermination, the Marine Hospital Service has conducted experiments in the field which tend to show that rats can live an indefinite time without water. Three of the animals were put on a diet consisting of bread, meat, and cheese, but no water, and all were alive and well 60 days after the experiment was begun. On the fifteenth day one was given an opportunity to drink, but made no attempt to do so. When kept without food, but with water one rat lived three days; and of six rats deprived of both food and water, all died within periods ranging from two to five days.

"Night Wells"

A CURIOUS form of water-hole is found in the deserts of western Australia, dry by day, but yielding an abundant supply of water by night. The flow of water is preceded by weird hissings and sounds of rushing air. The phenomenon is discussed by Dr. Malcolm Maclaren, in the *Geological Magazine*, who has, however, personally located and examined only one of these wells. He found that the water supply occurred in a long narrow trench, at the bottom of which was a thin plate of gneiss, separated by a cavity from the main rock mass beneath. Apparently the heat of the day causes this plate to expand in the form of a depression, into which the water retreats. When it cools and contracts at night it forces first air and then water back into the trench.

Celilo falls. Completed section of canal in foreground.

The head of the Celilo canal.

The Celilo Canal

By W. H. Ballou

OPENING of the Columbia River to navigation from its mouth to British Columbia is a project that has been taken up energetically and may be realized within a very few years. Steamers now bring freight to Portland from Lewiston, on the Snake River, one of the Columbia's chief tributaries, but an impassible barrier is presented at Celilo Falls and the nearby rapids, where reshipment of freight is necessary.

The most important work in opening the Columbia River to traffic is now going forward at Celilo, where a canal, on the Oregon shore of the Columbia River, 8½ miles long, with 5 locks, is being built. Two of the locks will be placed at the lower end of the canal, the total lift at this point being 70 feet. Another lock at the head of Five Mile Rapids will have a lift of 11 feet. A lock at Ten Mile Rapids, which will be used at certain stages of water only, has a lift of 5 feet, while the fifth lock, at the upper end of the canal, with a maximum lift of 9 feet, will also be required at certain stages of the river.

Rock excavation for the tandem locks.

The project now under way was authorized by Congress by an act approved in 1905. The cost of the work will be almost $5,000,000. The work involves the excavation of 1,300,000 cubic yards of rock, 750,000 cubic yards of sand, 700,000 cubic yards of earth, the construction of 200,000 cubic yards of concrete and 5,000 cubic yards of rubble masonry.

The Rivers and Harbors Act of June, 1910, appropriated $600,000 for continuing construction on the canal with a view to completing it in 6 years. The new work includes the excavation of about 5½ miles and, in addition, the placing of a concrete lining in sections excavated under former contracts, as well as the designing and installation of lock gates and machinery. Maj. Jay J. Morrow, Corps of Engineers, U. S. A., in charge of the first Portland district, decided, at the time of the last appropriation, that it would be advantageous to supervise the work directly rather than let contracts, as had been done previously. This plan was approved by the Chief of Engineers, U. S. A., and First Lieut Henry H. Roberts, Corps of Engineers, U. S. A., was at once placed in local charge of the entire project, involving the completion of contracts already in effect, and the completion of work by hired labor. The organization of affairs required some little time, but construction work was gotten under way in October, 1910, and it has proceeded steadily ever since.

In prosecuting the work, careful tests have been conducted by the officers in charge, to determine the qualities making for the best results, and materials have been placed in the work strictly on their merits. An odd feature is the maintenance of a sand-crusher plant, whereby stone rejected from the rock crushers, which crush rocks for concrete, are reduced to sand. This is somewhat singular from the fact that there are sand dunes nearby where this material could be secured; but it is found that by manufacturing it, its cost is not only reduced, but the tests show it to give a greater tensile strength to concrete than any natural sand available for the work.

The Columbia River Valley is one vast granary, and in autumn great piles of wheat sacks are placed at railroad stations and river landings awaiting shipment to the Portland market. Great economies in transportation will be effected if this great tonnage of wheat can be placed on board steamers and floated down stream all the way to Portland. This is ideal transportation, effected at the least possible cost. At present a portage railroad at Celilo transports freight, both up and down the river, past the places in the stream impossible of navigation. This additional hauling of freight is expensive and causes delay.

The canal work is expected to be finished not later than 1916, and when this is accomplished the wheat, hay, fruit, and much of the livestock, which comprise the chief staple products of the Inland Empire, will find an ideal outlet to Portland, and thence by water or by rail to the markets of the world.

Instrumental Observation of the Sun's Heat

By the Paris Correspondent of the Scientific American

THE instrument which is being used by Dr J. Dupaigne in France for observing the heat of the sun presents several interesting features, one of these being a thermometer made with a hollow conical bulb. The aim is to have the sun's rays fall upon a cell or absorbing chamber so that the effect of the rays will be thus concentrated. An ordinary thermometer, even though blackened, will always reflect a good part of the rays, and these will be lost. Dr Dupaigne had the idea of making a combined cell and thermometer. Instead of using a solid bulb, he makes a double-walled one in such a way that the mercury is spread around in a thin layer just as it would appear if put between a double funnel, and the stem of the funnel extends as a tube so as to form the thermometer. When the sun's rays fall into this conical-shaped cavity (A in the diagram, Fig. 1), which is blackened so as to absorb them, they are not reflected again, as they are caught by the sides of the narrow funnel, which has a 30 degree angle. This principle is due to M. Féry, but Dupaigne here applies it to a thermometer for the first time. This is placed inside a Dewar double-walled and silvered globe so that the bulb cavity is turned toward the sun's rays and the long stem of the thermometer extends to the rear. The globe acts so as to prevent loss of heat. In this way the user is able to estimate the heat of the sun under the best conditions. It is the quantity of heat and not the temperature which is measured, and such an instrument is a special form of calorimeter, here shown in Fig. 2 and named actinometer.

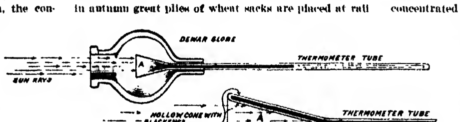


Fig. 1.—Diagrammatic illustration of the method of absorbing the sun's rays, so caught by the sides of the blackened hollow cone A that they cannot be reflected and lost. The lower sketch is an enlarged view of the cone or funnel.

Fig. 2.—The actinometer in position to receive the direct rays of the sun.

Night Letters in Italy

A NIGHT letter service similar to that which has become so popular in the United States and Great Britain has just been adopted by the telegraph system of Italy (a state institution). According to a law recently passed this service is, for the present, applicable to a list of designated places. A uniform charge has been adopted of 2 centesimi (about $0.004) a word, with a minimum charge of 60 centesimi ($0.116).

Burning Up Bad Roads to Make Good Ones

By C. H. Claudy

GOOD roads present many different problems in different localities, according to the building material at hand and the character of the soil. Perhaps no more difficult conditions for the making of good roads exist than in the lowlands of the Mississippi Valley, where centuries of swamps and tons of decayed vegetable matter have incorporated in the "gumbo" or "buckshot" clays of that region a plasticity and mud-making ability which produce the worst "roads" in the world.

During certain seasons of the year, these so-called "roads" are absolutely impassible, vehicles sinking to the hubs and horses getting so mired that they must either be shot or dragged out with ropes, often with broken legs to pay for their drivers' temerity.

To make a good road out of this "gumbo" is a problem, the importation of sand for a sand-clay mixture is too expensive, and there is not enough rock in these localities to make a hitching stone, let alone a macadam road. But a solution of the problem has been found in the "burned clay" road, in which the "gumbo" is so changed in character by firing as to present a fairly hard and mudless surface, even after a heavy rain.

The "gumbo" clay is black from the large percentage of organic matter it contains, and from the same reason is peculiarly sticky and plastic. But after having been baked, it forms a clinker, which, while not rock-like in its hardness, shows no tendency to form mud when mixed with water. This surprising fact is made use of by the farmers living in the "gumbo" regions, to make the "burned clay" road. Luckily the districts of "gumbo" are heavily wooded, and fuel is cheap and does not need to be hauled. The process of making a "burned clay" road is as simple as it is novel. The width of the road is determined, and it is ditched on either side. Next the surface is plowed up as deeply as possible, and even four mules make a hard job of dragging one plow through the sticky clay. The plowed up clay is then thrown into furrows across the road, making ridges about four feet apart. Cord wood is laid closely across the tops of these ridges, making a wooden floor above the clay, the furrows and ridges forming flues. Fire wood is piled irregularly on this wooden floor, with masses of clay filling in the open spaces. A second course of cord wood is laid on top of this mixture of wood and lumps of clay, and all openings filled with kindling and light wood. The whole is then covered with a clay blanket—usually taken from the ditches on either side—to a depth of a foot, and tamped and rounded off so that the heat may remain in the mass as long as possible. Where coal slack is available, it is often substituted for wood. The point is to get heat regardless of what fuel is used.

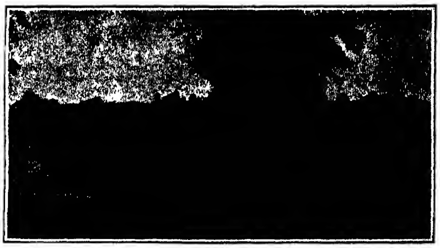
When completed, the flues are fired so that they will get the draft down wind. The workmen pay careful attention to the burning, and when any part of the fire seems to slack up, reinforce that flue with light kindling, so that an even burning is maintained throughout the mass.

When the wood is all burned—the organic matter in the clay aiding the combustion and in giving off heat—and the mass sufficiently cool, it is found that all the clay on the first floor, all the clay on top, and even the ridges of clay between the furrows, as well as underneath the lowest fire, has been thoroughly clinkered.

To make the loose mass into a road, nothing is needed but grading with plow or scraper to make a high crown in the center and a final compacting by rolling.

The result is a hard surface road which refuses to get muddy, which wears well, costs next to nothing to repair, and which provides a safe bridge through "gumbo" country. On either side of the roads all winter long, no carriage could roll—on top of the six to eight inches dressing of burned gumbo clinker, heavy wagons travel without difficulty.

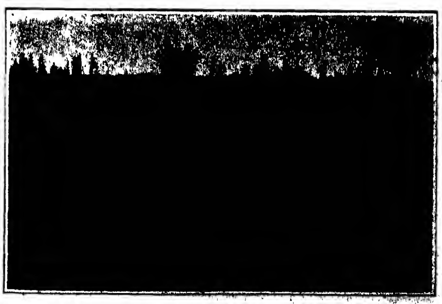
The cost of such a road varies between $1,000 and $1,500 a mile, a very small price to pay for a good road, and particularly in a district where, until the coming of the "burned clay," transportation except by railway was, in the winter time, an absolute impossibility.



Burned clay properly spread ready for leveling by rolling.

Showing the method of preparing the road for burning. All ready for firing.

Making a burned clay road. The burning of the layers of wood and clay.



A burned clay road, two years old, photographed just after a hard rain.

Salving the Steamer "Jose"

THE fruit steamer, "Jose," lay at her dock in the East River, New York, taking on a cargo of case oil and gasoline for Central American ports when a serious fire broke out. The vessel was towed out into the stream to prevent the fire from spreading to the dock and other shipping. The fireboats pumped such a deluge of water into the vessel that it sank off shore in thirty-eight feet of water. This happened on the 13th of March of this year, and it was not until the last of July that the work of raising the vessel, pumping it out, and delivering it to the owners could be completed. The wreck could not have been sunk in a more unfavorable position. The bottom on which it lay was covered with boulders which, at that point, formed a pocket about eight feet deep. This meant that the vessel would have to be raised at least ten feet before it could be towed to a position more favorable for the wrecking operations. The "Jose" lay right in the path of shipping, and at a point where the tides were so strong that work was actually limited to the period of slack water at high and low tides.

The task of raising the steamship was undertaken by the Merritt & Chapman Derrick and Wrecking Company, and the method they employed is pictured in our front page illustration. While the method is not a new one, we believe that our readers would be interested in learning just how such work is done.

The wrecking outfit consisted of six pontoons, three on each side of the sunken vessel, and two barges, the latter furnishing the steam for the pumps on the pontoons. The pontoons were provided with chain wells of the form shown, partly broken away in one of the detail views. The wells were of flat triangular form, flaring out at the bottom, which was open to the water, so as to allow for the sweep of the chain. There were four such wells to each pontoon, and the chains passed from the pontoons on one side of the vessel under the hull and to the pontoons on the other side. Beside each chain well, there was a mast which was provided with fall and tackle by which the slack of the chain was taken up. The chains as they emerged from the wells passed through planks fulcrumed at one end, and arranged to be lifted by hydraulic jacks at the other end. The chains, after being drawn up taut by the tackle, were fastened to the planks by means of toggles, or U-shaped pins, fitted under the chain links, and then hydraulic jacks were operated to secure a uniform tension.

As the pull of the wreck on the chains would tend to cause the barges to come together, they were kept at the proper distance apart by means of beams known as "spreaders." There were also top timbers that ran across the wreck from pontoon to pontoon, and were fastened to the pontoons by means of chains that passed around their hulls, as shown clearly in one of the detail drawings. These served to keep the pontoons on an even keel.

Had the "Jose" rested on a soft bottom it would have been a simple matter to pass the chains under it. They could have been lowered under the bow and then worked back and forth until they reached the desired position. But as the wreck rested on boulders, such a course was impossible. It was necessary to get the chains under at fixed points corresponding to the position of the chain wells on the pontoons, and this necessitated in many cases the blasting of a channel under the wreck, through which a small chain could at first be passed, and then be used to haul a heavier chain through. The divers could not work at the bottom when the tide was running, as it was strong enough to sweep them off their feet. In the short intervals of slack water, but little could be accomplished, and so the work dragged on through several months. There were a number of delays, due to snapping of the chains when the pontoons were rocked by swells. As the wreck lay in the path of navigation there was much apprehension whenever any large vessel passed by. However, the regular sound steamers very considerately reduced their speed when passing the wreck so as to prevent any accidents. The chains were also crushed by contact with the boulders as the vessel was moved over them.

Although the task of passing the chains

(Continued on page [illegible].)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Suggestion for Typewriter Makers

To the Editor of the SCIENTIFIC AMERICAN:

I would like to suggest that the manufacturers of typewriters adopt a keyboard that would be best adapted for the touch method of operating and all of them manufacture the same.

This would standardize the typewriter like musical instruments, most notably the piano and would be of convenience to people in obvious ways.

Santa Ana, Cal. B. T. BAKER.

The First Parachute Drop from an Aeroplane

To the Editor of the SCIENTIFIC AMERICAN:

We beg to call your attention to an error in your issue of July 6th, on page three, under heading of "Aeronautics," in which you state that the first parachute drop from a flying machine was made by Law. For your information we would like to state that the first successful drop from an aeroplane was made by Bert Berry in a Benoist biplane, driven by Tony Jannus, at Jefferson Barracks, Mo., February 29th, 1912. You can find an account of this in any of the New York papers the day following, as this attracted universal attention, and was taken up by many of the foreign papers, the *London Graphic* carrying photographs on the complete front page. We are inclosing herewith a description of this taken from *Aero* of March 9th. THE BENOIST AIRCRAFT COMPANY.

St. Louis, Mo.

Determination or Free Will?

To the Editor of the SCIENTIFIC AMERICAN.

In the issue of August 17th, 1912 a Mr. Paul R. Birge makes this rather startling, positive and dogmatic statement: "From the deterministic, the only thoroughly scientific standpoint, there is no line separating responsible wickedness from acts against the public peace which have their origins in perversities, etc."

He here out-Haeckels Haeckel in making a statement, which, to the hasty reader, would pass for a scientific truth grounded upon fact while in truth he has not proved the statement. What is science? The following is Huxley's definition (see "Value of Natural History Sciences," Lay Sermons, page 73): "Science is nothing but trained and organized common sense."

Prof. Haeckel says in brief on page 6 of "The Riddle of the Universe:" "All purely scientific investigations consists of: firstly, experience; secondly, inference."

Is determination proved from experience? It is not. In fact all experience and common sense is for the freedom of the will. We make a practical application of it every day. As Doctor Johnson says, "Sir, we know our will is free and there's an end on't; all theory is against the freedom of the will; all experience for it."

As determination cannot be proved from experience, according to the above definitions of science, it is therefore not a thoroughly scientific standpoint. Theories that are not grounded upon the facts of experience have no right to be called scientific, still less to be called thoroughly scientific and the only scientific standpoint.

I wonder which is the more scientific, determinism or Free Will?

Washington, D. C. C. H. K.

Bow-on Collisions

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 17th, under head of "Danger of Bow-on Collision," your Californian correspondent seems to have entirely overlooked the fact that the strength of the plates which compose the hull of an ocean steamship as compared with the total weight of the ship are an almost negligible quantity.

He says "when the forward motion of a ship is *suddenly stopped* nothing whatever could hold the boilers and engines from breaking loose and going forward and smashing the bulkheads and probably the bottom," and then he pictures the horrible results from the breaking of the steam pipes.

Now anyone with the least amount of practical knowledge of the strength of material knows that such conditions are impossible.

A big steamship, as a whole, cannot be instantly stopped because the force of any blow that may strike the outside of the hull will be taken up by the successive crumpling of the plates, so that in a very large ship scarcely any jar would be felt in the middle of the ship, as was, in fact, noted by the passengers on the "Titanic."

Such results as your correspondent imagines could only occur if the ship were built of so great strength as to be virtually one solid body, but as such a ship could not float at all, the conditions are impossible.

The reason why no notice was taken by any newspaper of the letter which Mr. Fraser sent to the Investigating Committee is self evident, for it seems to be a waste of space for any paper to publish so absurd a theory.

Gloucester, Mass. REUBEN BROOKS.

The "Akron" Accident

To the Editor of the SCIENTIFIC AMERICAN:

We have noticed with interest the various reports which have appeared in the SCIENTIFIC AMERICAN, as an attempt to explain the explosion of the dirigible balloon, "Akron," at Atlantic City, on July 2nd. We find it necessary to correct a few points on which you have apparently been misinformed. It is true, to a certain extent, that the "Akron" showed no speed lines. It was not built for them. It was built according to the specifications which we received, and corresponds exactly to them.

The rudder was not small, although perhaps not quite properly balanced, and required too many turns of the wheel to move it.

The "Akron" was equipped with aeroplane surfaces of about sufficient size to give a reaction of about 1,000 pounds either up or down. Such a reaction would be sufficient. There was only one pair of orientable propellers, driven by the central power plant. There were U-tube pressure gages from all the ballonets and from the gas compartment.

The hydrogen used was exceedingly pure, and tests showed that the fabric had suffered practically no deterioration from this or any other cause.

You may be interested to know our views in the matter.

There was no representative of the Goodyear Tire & Rubber Company in Atlantic City to witness the accident, and, consequently, we must base our conclusions on the various and some times conflicting reports of those who were eye witnesses, and upon the investigations which we have made as thoroughly as possible of the remnants of the wreck.

The wreckage was raised from the water at considerable expense, and its condition carefully noted Sample pieces of fabric were tested out, and all possible tests made that could in any way throw any light on the cause of the accident, and probable reason for it.

We regret that our statement, from the very nature of things, cannot be as explicit and satisfactory as we would like to have it. However, we will give it to you for what it is worth, and from it you can draw your own conclusions. We have made it out in the form of a general discussion of all the theories of the possible cause of the accident. It is hard to tell which one is the most plausible.

In thinking of the dirigible balloon "Akron," kindly remember that the gas bag only was constructed by the Goodyear Tire & Rubber Company, and that, according to the general specifications and suggestions of Mr. Vaniman. The car and the entire work of assembling was carried on at Atlantic City under the direct supervision and direction of Mr Vaniman. We believe strongly in the future of the dirigible, considering it only a matter of time before its development in this country will equal and surpass its development in Europe and other foreign countries. We believe that this accident contributed a great deal to the science of the manufacture and operation of the dirigible balloons.

We are ready to construct dirigibles of any type, and will welcome anything that you can do to assist in bringing the dirigible to its successful completion in this country.

Any and all of this letter is for publication if you so desire, for we are willing and in fact wish everybody to know the true facts of the case. We are glad to furnish any and all information which we can, which will in any way throw any light on this unfortunate accident, and aid the science of aeronautics.

Unfortunately a complete examination of the gas bag was impossible, as a large part of it had been cut up and carried away as souvenirs, before it could be protected. Our complete report is as follows:

A large number of witnesses were investigated, whose accounts vary greatly as to detail, but the following summary covers the points on which reliable eye witnesses agree and which we have determined from our investigations.

The balloon started directly away from the hangar, and holding its course, proceeded to a point over Brigantine Beach, then made two wide circles, and was making the third when the accident occurred. The ship was rising during the whole time that it was in the air, and had attained an elevation of about 2,500 feet.

Shortly before the bag collapsed the bow of the ship seemed to be pointed downward and the orientable propellers running, apparently in an effort to bring the ship down to a lower level. Accounts vary as to the exact method of collapse of the bag but the general opinion is, that the rent in the bag occurred near the stern; the ship was almost on an even keel, and poised a moment in that position, then the stern sank and she plunged downward; when part way down the greater portion of the bag tore loose from the car; the car shot downward stern first in a nearly vertical position until almost down to the water, when it swung around, partially righting itself, then struck stern first in nearly its normal position. The portion of the gas bag which had been torn loose, dropped into the water a short distance from the wreck, and floated up the channel with the tide.

There have been several theories advanced as to the cause of the accident

(1) *Fire or explosions* —There was no evidence confirming this theory, the tanks, while battered up and more or less broken to pieces, showed no signs of having been ripped open by an internal explosion All the motors were recovered but the small one and the cylinders found to be intact. Some of the bodies were burned, but the doctor who examined Calvin Vaniman stated that those burns were probably made by hot liquid of some kind (presumably hot water from the radiators) and not by hot iron, burning gasoline, or by flame

A violent explosion of gas would have been impossible. Recent tests of the gas showed it to be over 80 per cent pure hydrogen, although the balloon had been inflated nearly four months. There was no signs of fire discovered on any part of the balloon except one small spot on the fabric, which had evidently come in contact with a hot pipe. A few reports of smoke and flame having been seen are current, but most witnesses, particularly those familiar with the operation of gasoline engines, say that the smoke was only the exhaust from the engine, and that there was no flame.

(2) *Rupture of gas bag due to internal pressure* —There are many stories current as to the gas bag being made of under-strength fabric, or that it rotted from exposure, or from impurities in the gas The facts are these

Mr. Vaniman specified in his design a maximum pressure corresponding to 1 inch of water. The balloon was actually built to stand an ultimate pressure of 8 inches, thus giving a safety factor of 7, which considerably exceeds the usual figure. But there was reason for this excess strength It was to be an experimental machine of rather a novel design, and the first ever made in this country. Likewise, Mr Vaniman, although a great inventor and genius in his way, had not had the long practical experience with dirigibles which is given the European pilots, and which insures their doing the right thing at the right time As to the fabric being rotted by the gas, or otherwise, it is sufficient to say that samples cut from different parts of the bag after the accident, showed no material deterioration in strength All seams were triple reinforced and showed far over the 100 per cent efficiency as recorded by the numerous tests. Although, on account of the souvenir hunters it was impossible to tell where the bag had first broken, it is manifest that no seams (so far as observed) had been even strained.

In spite of the extra strength, the balloon could very easily have been burst by letting the pressure go up to an excessive amount It would take a fabric 50 times as strong to resist all the expansion likely to occur from the sun's rays and it would be impossible to resist that due to increasing altitude. There is some slight evidence which seems to point in this direction. It was morning, the sun was getting hot and the balloon was rising at the time of the accident. Only the two rear engines were running There were scalds on Mr. Vaniman's body which would indicate that something had called him to the rear of the car, away from the pilot's bridge where the pressure gages were located He had a large automatic safety valve of French manufacture, which should have been ample to take care of just such an emergency, but we found on examination that he had provided it with extra springs since the first flight, which did not allow it to open fully. On the other hand the bottom of the bag was made purposely weaker than the top so that if it did burst it would in all probability retain enough gas to let the machine down in safety.

(3) *Breakage of the suspension ropes* —This theory has not to our knowledge been advanced before, but it would well explain all the observed facts and has strong evidence to recommend it The size rope used for supporting the car gave a nominal safety factor of only about three (3), and they had been tightened up much beyond their proper allowance We have it from two of the mechanics that these ropes had been breaking frequently when simply standing in the shed. If two or more of them happened to break at once, all the others would speedily follow suit, thus throwing all the strain on the bottom fabric, tearing it open and ripping the whole bag from the car.

Propeller breakage —This also seems a plausible theory. We regard it as practically impossible that a propeller could have broken from centrifugal force alone. They were of wood, run at a slow speed, and were specially designed for the work by a reputable French concern. If, however, any part near the one broke, a suspension rope for instance, a blade striking it, would be easily broken off and might fly into the gas bag in such a way as to cause a fatal rupture

While we deplore the fact that it was impossible to determine the exact cause of the accident, one may well take satisfaction in the fact that all the accidents outlined above are entirely preventable.

In the meantime, we cannot appreciate too much the work of those who went to their death for the cause that is yet new, and which, like everything new, demands more than its share of money and lives

THE GOODYEAR TIRE AND RUBBER COMPANY,

Akron, O. *Aeronautic Supplies Department.*

Fig. 1. -Menhirs at Chenat.

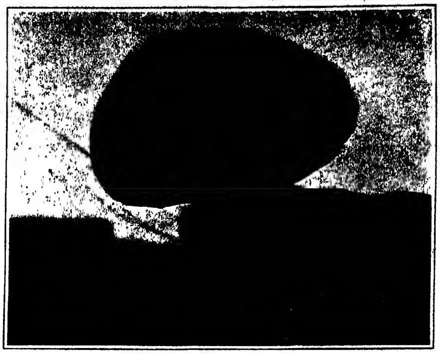


Fig. 2.—The rocking stone at Boussac.

Fig. 3. - The Urbe Dolmen.

Curious Megalithic Monuments of France

By Jacques Boyer

WE will not commence this article with a minute study of the 4,458 dolmens and roofed alleys which the French Commission of Megalithic Monuments has recently catalogued, but we will simply, in the first place, glance at these imposing relics of prehistoric times, that are doubtless contemporary with the menhirs, colonnades and cromlechs, which we shall speak of later.

According to the definition given by Bonstetten and generally adopted by archeologists, a dolmen is a monument of stone, bare or covered with earth, and of dimensions sufficient to contain several tombs. It is constructed of a variable number of rough flat stones supported in a horizontal position by a variable number of stone pillars. The number of pillars may be only two, as in the dolmen known as the Merchants' Table at Locmariaquer in Morbihan (Fig. 5); three, as in the Pierre-Levée at Brantôme in the department of Dordogne (Fig. 6); four as in the Urbe dolmen in Creuse (Fig. 3), and the Roche-aux-Loups at Beaumont in Dordogne (Fig. 7), or a still larger number.

If the dolmen contains many pillars supporting several entablatures, it is called a roofed alley.

An exceedingly fine specimen of this class, the Roche-aux-Fées (Fairies's Rock), is still seen standing near Rétiers in the Department of Ile-et-Vilaine.

The megalithic monuments are not evenly distributed throughout France. They are rare in the east and southeast except in the departments of the Aube and the Alpes-Maritimes, according to the statement of Joseph Déchelette in his "Pre-historic Archeology" (1908). They are found most abundantly in a

Fig. 4.—Menhirs at Lampary.

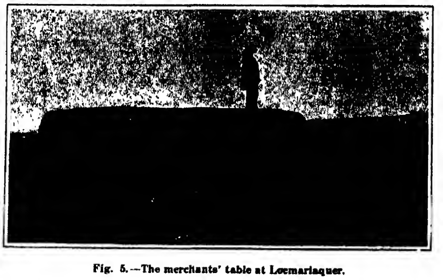


Fig. 5.—The merchants' table at Locmariaquer.

zone included between the Breton Coast of the English Channel and the Mediterranean shores of the departments of Gard and Hérault. Two very compact groups may be distinguished: the southern group, including the five departments of Ardèche, Aveyron, Gard, Lot and Lozère; and the western or Breton group, which is most densely aggregated in Finistère and Morbihan.

The attentive study of the dolmens and roofed alleys shows that their builders placed the large entablature stones with their plane faces downward or inward, paved the floor below with smaller flat stones and, in general, filled the interstices with still smaller stones. Some of the pillars and roof stones are so huge that it seems almost impossible that they could have been transported and assembled in the infancy of civilization with the aid of rudimentary tools, especially as some of these stones have evidently been transported to considerable distances. For example, a stone weighing 40 tons, found at Perotte has been moved 19 miles and one at Moulins 22 miles.

The method employed by these prehistoric builders are entirely unknown to us; but experience has demonstrated the possibility of transporting and erecting very heavy masses without the aid of complex machinery or even of ropes. The stone can be raised by means of a series of levers and supported by placing earth beneath it. After the block has been raised to a certain height it can be allowed to glide down a sloping bank of earth plastered with clay, and by repeating these operations, the stone can be transported to an indefinite distance. Possibly the cave dwellers made use of ropes and of round logs, rolling on a path paved with smaller logs or planks. Whatever method was employed, the construction of the megalithic monuments required a spirit of order and discipline.

(Continued on page 185.)

Fig. 6.—The Pierre-Levee at Brantome.

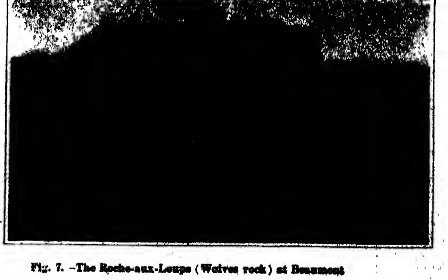
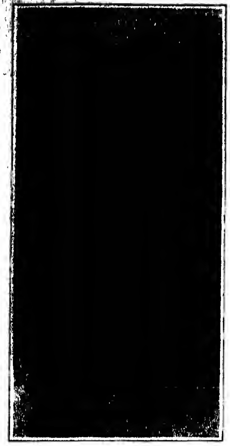


Fig. 7. -The Roche-aux-Loups (Wolves rock) at Beaumont



The effect of acid rainwater on a galvanized water pipe of cheap Bessemer steel in service about five years.

Hand-fired boilers, showing production of smoke by careless and uneconomic firing. Loss of efficiency is probably between 10 and 15 per cent.

A besmirched monument. Carved lampposts in front of Carnegie library, showing soot discoloration.

Smoke, the Destroyer

By R. C. Benner, Ph.D., University of Pittsburgh

According to the smoke inspector of Chicago, the black fumes belched by the chimneys of his city cause an annual loss of fifty million dollars in ruined merchandise. Since one third of the American population lives in cities, the United States Geological Survey estimates, on the basis of this smoke inspector's figures, that the total loss caused by soot reaches a dizzy total of six hundred million dollars. Here is indeed a problem for the scientist. That he has not neglected his opportunity is evidenced by the following article, which, written by the chemist in charge of the University of Pittsburgh's smoke investigation, shows exactly to what the destructive action of smoke is due.—EDITOR

IT may seem surprising that an architect should specially interest himself in the purification of the air, but the problems confronting him in the designing of buildings to be erected in a smoky town are so manifold as to make a clean atmosphere a matter of moment. For architecture does not depend upon a knowledge of materials alone, nor upon designs of beauty alone, but is very dependent upon the atmosphere, and when smoke pollution is taken into account one has much to contend with.

Soot possesses the properties inherent in itself for making the worst possible kind of dirt.

1. Finely divided carbon forms the basis of our best black paints. It is opaque and has a large covering power, i. e., a little will make a large surface dirty.

2. It contains tar, which, as well as being black and corrosive, causes the soot to stick to any material with which it comes in contact.

3. Finely divided carbon has a great absorbing power, absorbing large amounts of the sulphur acids, more especially sulphurous and sulphuric, with minor amounts of hydrogen sulphide.

No wonder that our houses look grimy and miserable and that the use of skylights in many places is made impossible, while in others it is necessary so to arrange them that they may be readily cleaned. Otherwise they would soon become useless because of the accumulation of soot.

Again, changes in design so as to make a different arrangement of drain pipes, etc., are, at times, necessary in order to prevent the splashing of rainwater containing soot upon the building.

In a smoky city, too, much more glazed tile and vitrified brick is used for the outside of buildings, as it makes the cleaning a comparatively simple matter, washing alone being necessary. Building stones, such as limestone, marbles or sandstones, with calcareous binding material are rapidly disintegrated by the acid in the soot and the air. Therefore, materials such as granite, sandstone (with a silicious binding) brick, etc., which are not attacked by the sulphurous and sulphuric acids in the soot, should be utilized. But, unfortunately, that stone which is most easily affected, disintegrated by the atmospheric acid and decolorized by soot, is the one which it is easiest to work into the desired shape for building purposes. Granite and similar stones, which are practically unattacked by acid and impervious to moisture, consequently offering little chance for the soot to lodge and readily cleaned, are extremely expensive because of the difficulty in working. Thus the architect finds himself confronted with monetary considerations.

In Glasgow, several years ago, the subject was widely discussed and various remedies were advocated, i. e.: Painting the stone with paraffine, similar to the treatment given the Obelisk in Central Park, New York, and covering with solutions of soap and alum, silicate of soda, carbonate of baryta, etc, and also patented preparations. These are all more or less effective and tend to reduce the evil effects of the acid and soot to a minimum by closing the pores of the stone. Sand blast is used for cleaning in some places, but this abrades the surface, leaving it rougher than before.

Hydrochloric acid is utilized for washing down stone walls, but it must be used with care, as discoloration is likely to follow. Cleaning the stone is at least but a temporary expedient and represents a periodic tax on the owner. The logical thing is to make cleaning unnecessary by water-proofing the stone and doing away with the smoke.

The sulphuric acid in the air and occluded in the soot acts on calcium carbonate (the principle constituent of stones most readily corroded by the acid in the soot), and forms calcium sulphate (gypsum), which is more readily soluble in water than the calcium carbonate but, at the same time, causes the stone to undergo a physical change, making it swell and become porous and friable and easily disintegrated, also roughening polished surfaces, thus making them more susceptible to attack by acid and moisture and also easily affected by weather.

Dr. Angus Smith has found mortar to contain 28.33 per cent of sulphuric acid, equivalent to 48.16 per cent $CaSO_4$ caused from the action of the sulphuric acid in the air on the calcium carbonate. Limestone and marbles have been found to contain 0.52 to 3.85 per cent $CaSO_4$, and because of the comparative ease with which this substance is soluble in water, the surface is readily eroded. The effect of the sulphuric acid absorbed in soot is rather marked on most metals and greater than the action of a like amount of acid in the rainwater or air. It would seem from observations taken in Pittsburgh that soot containing acid adheres to the metal by means of its tar content and forms an electrolytic couple, thus making corrosion much more rapid. In the case of iron and aluminum, the oxide (or basic sulphate) is produced, at least in part, from the sulphate, and the acid is used over and over again.

Lower story of Keenan Building after it had been washed down. This story is cleaned twice a year.

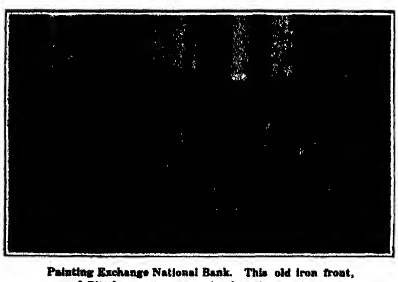
To experimentally verify these observations, duplicate sets of various metals were fastened to two boards. One set was protected from the soot in the air by means of cheese cloth, yet still exposed to the air and the rain. The other set was left unprotected from the soot and it shows a much greater amount of corrosion.

The following figures obtained by Messrs. W. B. Worthington and A. Rattray, show the accelerating effect of the acids in the air. Quoting from Cohen, "A number of rails were placed in suitable positions by the side of the line, and weighed at intervals and the loss of weight recorded. The rails were of the ordinary railway section weighing 86 pounds per yard." The annual loss of weight from corrosion was as follows:

	Loss in weight in pounds per average year	No. of years of observations
1. In the center of the town	1.04	17
2. In adjoining place in smoky tunnel	1.48	13
3. In a wet place in same tunnel	1.71	8
4. On the seacoast among sand hills	0.18	17

The question of exterior and interior decoration is one affected as much by the amount of smoke in the air as by the tastes of the owners of the building. Interior

(Concluded on page 186.)



Painting Exchange National Bank. This old iron front, one of Pittsburgs structures, is given two coats a year.

The Heavens in September

Indications of the Sun's Motion Through Space at 12 Miles per Second

By Henry Norris Russell, Ph.D.

WE considered last month some of the conclusions which might be drawn from a study of the motions of the stars in Scorpius and Sagittarius; but we were far from exhausting this topic.

The diagram, showing the amount and direction in which each star will move in the next hundred thousand years is reprinted here, and, for comparison, a second is given exactly similar in nature, but exhibiting a portion of the northern heavens (now visible in the evening sky), in which the constellations Lyra, Hercules and Corona Borealis may at once be recognized.

Each illustration shows all the stars in the given region which are brighter than the fourth magnitude, with the addition of a few slightly fainter ones to mark certain familiar constellation figures

It needs only a glance to see that there are very marked differences in the way in which the stars in these two regions of the sky are moving. In the vicinity of Scorpius almost all the stars are moving southward and westward (that is, downward and toward the right on our diagram) This applies not only to the stars of the moving cluster which we described last month (which are all going in the same direction and at the same rate), but to the remaining stars, which though moving in different directions and at different rates show the tendency to move downward in all but two cases out of sixteen, and a distinct, though less overwhelming tendency toward the right.

In the region of Hercules the situation is quite different Hardly any two stars are moving in the same direction or at the same rate, and motions to the right or to the left, up or down, occur with an entire lack of system, while four stars are moving so very slowly that even in 100 000 years they will not have changed their position by an amount great enough to show on the diagram, so that they appear simply as dots with no arrows attached to them

In the first region we have some approach to order in the stellar motions, in the second we find chaos It may seem at first sight surprising that it is the order, and not the chaos which demands explanation, but we must remember that the stars which seem to us to be neighbors in the sky, and to form a definite configuration have usually no real connection at all; some are many times as far away from us as others, and they only seem near together because they are nearly in line with one another from our particular point of view We need not, therefore, expect to find the stars of a given constellation moving in the same direction, much less at the same rate, and, unless we can show some definite reason to the contrary, we may expect to find as many going northward as southward, and eastward as westward

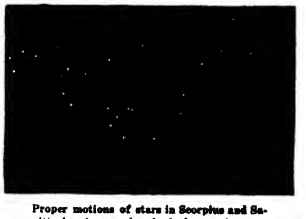
This is just what actually happens in the region of Hercules, and we may, therefore, rest content to ascribe what we observe there to mere chance

Something more than chance, however, determines the apparent *rate* of the stars' proper motion. Of two stars, each of which is really moving (at right angles to our line of sight), at the same number of miles per second, the nearer one will seem to move the faster, in direct proportion to its nearness It is, therefore, likely that the stars which have the largest proper motions are the nearest to our system But this is by no means an infallible test, for a star whose actual motion, in miles per second, is very rapid, will seem to move fast, even if at a considerable distance In spite of such exceptions, it is undoubtedly safe to assume that the stars whose apparent motion is rapid are, on the average, much nearer than those which seem to move slowly

These principles are well illustrated by the four fastest moving stars shown on the Hercules diagram They have all been repeatedly observed for parallax, and the results show that they are all relatively near our system

Zeta Herculis (shown in the upper right-hand part of the figure) is the nearest, its distance being about 23 light-years Next come μ Herculis and Vega (the two rapidly moving stars in the left-hand half of the diagram), whose distances are 31 and 35 light-years, according to the latest observations. The star of largest proper motion of all in the region, γ Serpentis,

Proper motions of stars in Hercules, Corona and Lyra in one hundred thousand years.



Proper motions of stars in Scorpius and Sagittarius in one hundred thousand years.

appears to be farther off, about 60 light-years (according to the mean of three measures of its parallax, which do not agree as well as in most cases). Its actual rate of motion must be much more rapid than that of the other stars. But why do the stars in Sagittarius behave so different? It may still be true that those which seem to move fast are, on the average, nearer to us than the others; but this does not explain the general southerly drift of all the stars in the region. If this peculiarity was confined to the constellation we might be content to say that the stars in this particular part of the heavens had a peculiar tendency of their own; but much the same thing, though not to quite so marked a degree, is found in other parts of the sky. There is a distant preference, among the motions of the stars for a certain quarter, and an avoidance of the opposite quarter. The favored directions run by no means at random. They all point away from the region of Hercules and Lyra, and, toward that of Canis Major.

Our Sun itself is the seat of the motion, and is steadily progressing through space, like the other stars, carrying all its attendant planets with it. The apparent drift of the heavens is the reflection, if we may so speak, of this motion of our system toward Hercules.

In either of these regions the influence of the solar motion changes only our distance from the stars, without influence upon their apparent motion across the sky, and we get a chaos of proper motions with no marked preferences. But when we look out nearby at right angles to the motion of our system, as is the case in Sagittarius, the apparent drift is at a maximum, and only those few stars which are going the same way as the Sun, but faster, appear to move opposite to the general run of the stars. It need hardly be added that this hypothesis of the Sun's motion has been fully tested, and the proof clinched by spectroscopic observations. The average rate at which we are growing nearer to Hercules, and farther from Canis Major, is twelve miles per second, which must obviously be the rate of the Sun's motion in space.

The Heavens.

The regions of the sky of which we have spoken are both visible in the early evening, though by our hour of observation a part of the southern one has set. We may still find Sagittarius near the southwestern horizon, and, passing northward over Ophiuchus, recognize Corona, Hercules, and Lyra a little north of west, the last high up toward the zenith. Cygnus is still higher, practically overhead. The Great Bear is low on the northwestern and northern horizon, with Draco and Ursa Minor above. Cassiopeia and Cepheus are above the pole, and below the former, in the northeast, are Perseus and Auriga. Taurus is rising, and Cetus occupies the southeastern sky. Above these are Aries and Pisces, then Andromeda and Pegasus. Aquarius and Capricornus occupy a wide dull region in the south. Lower down is the bright star, Fomalhaut, in the Southern Fish, and still lower the constellation of the Crane well visible only in more southern latitudes.

The Planets.

Mercury is morning star all through the month, and is well observable about the time of his greatest elongation on the 7th, when he rises only a little after 4 A. M. He is in Leo, and passes about five minutes of an hour north of the bright star Regulus on the morning of the 10th. This will be an interesting conjunction. The planet is much the brighter of the two, exceeding the star about fivefold.

Venus is evening star in Virgo, and may perhaps be seen low in the twilight in the latter part of the month, when she sets about 6:40 P. M. Mars is also an evening star, theoretically, but is too near the Sun to be observable.

Jupiter is evening star, setting about 9:30 P. M. in the middle of the month.

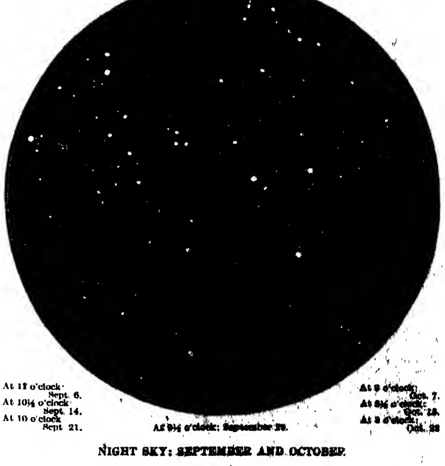
Saturn is in Taurus, and rises about the same time that Jupiter sets.

Uranus is in Capricornus, and comes to the meridian at 8:30 P. M. on the middle of September. Neptune is in Gemini, observable only in the morning hours.

The Moon is in her last quarter at 8 A. M. on the 4th, new at 11 P. M. on the 10th, in her first quarter at 3 A. M. on the 18th, and full at 7 A. M. on the 26th. She is nearest us on the 9th, and farthest away on the 21st.

At 5 A. M. on the 23d the Sun crosses the equator and enters the "sign" of Libra, though not the constellation, since the precession of the equinoxes has carried the two out of agreement since classic times. But in any event, we may say with precision that this is the moment of the autumnal equinox.

Princeton Observatory.

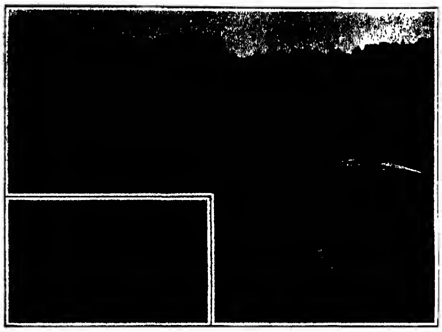


At 11 o'clock Sept. 6.
At 10½ o'clock Sept. 14.
At 10 o'clock Sept. 21.
At 9½ o'clock: September 29.
At 9 o'clock Oct. 7.
At 8½ o'clock Oct. 15.
At 8 o'clock Oct. 23

NIGHT SKY: SEPTEMBER AND OCTOBER

A Swimming Machine

AN inventor living near Paris has constructed an apparatus which for lack of a better name we may call a swimming machine. It consists of a light beam six feet long provided with a float at each end. The swimmer supports himself on this device with his feet on pedals under the rear float. By giving the pedals a reciprocating motion, he operates a propeller that drives the machine through the water. The steering is done by the hands and arms. With a device of this sort the swimmer can make a high speed through the water, because his energies are used to best advantage. The apparatus may readily be folded up and transported. The small insert shows the apparatus in use. The harness on the swimmer's back is connected by a wire to the supports of the rear float and enables the operator to gain a better purchase on the pedals.



Propeller driven swimming machine.

Truck for Aeroplanes.

DURING the recent war maneuvers the aeroplanes of the aviation squad were transported to the aviation station by a motor truck of standard make. The work of this motor truck was very satisfactory, considering the fact that it had to travel over bad roads and very rough ground. The aeroplanes, however, had to be completely dismantled in order to stow them on the motor truck. In European countries trucks of special design have been built for the purpose so that the aeroplanes do not have to be dismantled completely, and hence can be assembled more quickly. The accompanying photograph shows a truck of this type exhibited at the Belgian automobile exposition last winter. This truck is a trailer, not being provided with a driving mechanism, but being adapted to be hauled behind a motor truck or an automobile. The truck is designed to take a monoplane from which the planes have been removed, the latter being packed alongside the body of the aeroplane.

Truck for transporting aeroplanes.

The de Lesseps "Wind Wagon."

By T. M. R. von Kéler.

WHILE the idea of driving motor cars by means of an "aeroplane" propeller is not exactly new, the invention of Counte de Lesseps, shown in the accompanying photograph, presents several exceedingly novel features. It is by all odds the most elaborate attempt on the part of a motor car designer to utilize the pushing power of a large two-bladed propeller. The machine is not an ordinary automobile chassis in which the differential and transmission have been temporarily "declutched," so to say, but it is a car designed especially for this sort of propulsion.

The de Lesseps car has no "live axle," and all its four wheels are "free turning." The propeller is driven by a single chain leading from the main shaft to a short jack shaft to which the blades are fastened. Strong guards made of steel tubing and wire netting form a partial protection for persons approaching the whirling propeller blades. These guards are also expected to catch the broken pieces of the propeller blades in case of an accident. The motor is of 40 horse-power. In its long trial run of over 300 miles the car attained a speed of about 62 miles per hour over fairly good roads—a noticeable feature of the trial being that practically no dust was raised by its passage.

This latter very desirable attribute of such a car is easily explained by the absence of the slanting "dust pan," which hangs below the chassis of the ordinary motor car, and which deflects a strong air current directly upon the road surface. Furthermore, there is the free turning of the rear wheels, which in the de Lesseps car perform only a simple rolling motion, while in the axle-driven automobile the rear wheels exert a strong push or "flip" upon the road surface, causing it to disintegrate.

Difficulties which would tend to overbalance these advantages and to retard a general adoption of propeller drive are not missing. Starting the car in a strong headwind would be almost impossible, the forward pull and speed being largely dependent upon the movement of the surrounding atmosphere, in heavy sand or sticky mud it would also be difficult to obtain sufficient tractive power to overcome suction of the mud at the moment of starting. Once the car has been set in motion it is kept going at a small expense of power

Then there is the great danger of steering troubles, induced by the constantly changing speed of the car under changing wind conditions, and by the gyroscopic action of the large propeller, which submits the mechanism to enormous torsional stresses Tests made on the ice here in America with a similar "wind wagon" have shown it to be incapable of taking sharp turns at even moderate speed

While the de Lesseps car may be interesting from an engineering point of view, there appears little danger of its general introduction—at least in its present form.

The de Lesseps car starting a trip from Paris to Lyons.

Black Lightning Flashes

THE accompanying photograph of lightning, showing both bright and black flashes, was taken at Lake Benton, Minnesota, on the night of May 2d, 1912, at midnight The shutter was open one minute, during which time probably several successive flashes occurred.

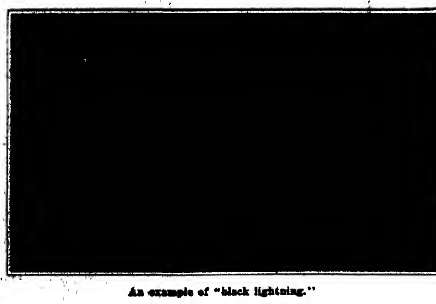
Black flashes are frequently seen in lightning photographs, and the conditions under which they occur are now well understood White flashes with black borders, as shown in the present case, are a characteristic feature of the phenomenon. The black flash does not occur in nature, but is a trick of the photographic plate, and different kinds of plates are sensitive in very different degrees to the process involved. The present picture was probably taken on a film, and shows the phenomenon in a marked degree

As long ago as 1889 Mr A W Clayden, the well-known English photographer, showed how to reproduce this phenomenon in the laboratory (*Philosophical Magazine*, 5th series, vol 28, p 92 94), whence it has since been known as the "Clayden effect" If an electric spark of moderate intensity is photographed, and the plate is subsequently exposed to a very feeble general illumination (e g., with gaslight), the plate, after development, will print an ordinary white flash, if the after-illumination is a little brighter, the spark will not appear on the print at all; and, finally, if the after illumination is still brighter, the spark will print black. In order to get black flashes, therefore, the plate must have been exposed at least twice to the light.

Suppose, now, that a lightning flash has registered its impression on the plate, and before the shutter is closed a second flash occurs in the same field. If the latter is bright enough, the clouds will be lighted up and the light reflected from them will produce the diffuse illumination of the field necessary to produce "reversal" of the original image. That often only the border of a bright flash is reversed is explained by the fact that this is less bright than the "core" of the discharge and is more easily affected by the subsequent illumination of the field

An attempt to explain the chemistry of this process (somewhat too technical to be given here) will be found in the *Verhandlungen der deutschen Physikalischen Gesellschaft*, September 15th, 1911, p. 676.

In photographing lightning for scientific purposes it is desirable to select plates that are as little as possible susceptible to the Clayden effect, for, as stated above, this effect may entirely obliterate certain flashes Tests of a large number of plates from well-known makers were made a few years ago by Dr B Walter, of Hamburg, to determine which are most satisfactory in this respect. (See *Annalen der Physik*, 4te Folge, Band 27, p 92.)



An example of "black lightning."

The Trade-mark as a Business Asset

By W. E. Woodward

[THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value, that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.

The following is the eighth of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, will include discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark protection.—EDITOR.]

Trade-mark Protection.—VIII.

(Continued from page 165, August 24th, 1912.)

An owner of a valid trade-mark is protected by law in its exclusive use, as he is in the use of any other property that he may own. But to obtain this protection his trade-mark must possess all the essentials of validity, and he must be able to prove infringement, in short, the burden of proof is upon the owner of the trade-mark alleged to have been infringed.

Infringement of a trade-mark is defined in Hesseltine's "Law of Trade-marks and Unfair Trade" as. "An imitation such as would be likely to deceive the ordinary customer in the usual course of trade in the purchase of goods of one person as those of another."

The question of the infringement of a registered trade-mark is covered by sections 16, 17, 18 and 19 of the Act of 1905. Section 16 is quoted here:

Sec 16 That the registration of a trade-mark under the provisions of this act shall be *prima facie* evidence of ownership Any person who shall, without the consent of the owner thereof, reproduce, counterfeit, copy, or colorably imitate any such trade-mark and affix the same to merchandise of substantially the same descriptive properties as those set forth in the registration, or to labels, signs, prints, packages, wrappers, or receptacles intended to be used upon or in connection with the sale of merchandise of substantially the same descriptive properties as those set forth in such registration, and shall use, or shall have used, such reproduction, counterfeit, copy or colorable imitation in commerce among the several tribes, or with foreign nation, or with the Indian tribes, shall be liable to an action for damages therefor at the suit of the owner thereof; and whenever in any such action a verdict is rendered for the plaintiff, the court may enter judgment therein for any sum above the amount found by the verdict as the actual damages, according to the circumstances of the case, not exceeding three times the amount of such verdict, together with the costs

Note that in cases of infringement of a registered trade-mark, suit may be brought in a Federal Court, that triple damages may be collected in case the proof of infringement is established, and the defendant will be forbidden to use the offending mark.

Infringement is a specific violation of the trade-mark statutes It falls under the broader and more general law of unfair business competition, which takes cognizance not only of trade-mark infringement, but also of all other devices of deception by means of which one person trades upon the reputation of another

Nims, in his excellent book on "Unfair Business Competition," says

"The use of a special mark in connection with particular goods or a particular business is a representation that those goods or that business or the goods or business of the person to whom the mark belongs; that they belong to the person to whom the mark has become identified If such representation is false a case of unfair competition exists. The law of trade marks therefore, is merely a specialized branch of the broader doctrine of unfair competition. Relief in trade-mark cases is afforded upon the express ground that every person is entitled to secure such profits as result from a reputation for superior skill, industry, or enterprise, or, in other words, from his good-will But, as has just been seen, this is the precise principle upon which relief is afforded in cases of unfair competition The right of action in technical trade-mark cases is based upon the ground that an exclusive property right in the mark is claimed, and that the mere use of a close imitation of it, by another, *ipso facto* creates a cause for action, regardless of the effect of such use or imitation But the courts in the past have frequently lost sight of the broad general principles of unfair competition and have sought to decide cases of unfair competition pure and simple 'upon principles analogous to trade marks' The owner of a technical trade mark claims it as his, regardless of the effect on others If someone else uses it or imitates it, the owner claims a right of action because the mark is his and his alone"

And further on, in the same volume:

"Unfair competition does not necessarily involve the violation of any exclusive right to use a word, mark, or symbol. It may arise from the use of words, marks or symbols which are free for everybody to use and are not subject to exclusive appropriation by any-one The existence of this right of action depends upon the question of fact, whether what was done in any special case tends to pass off the goods of one man as being those of another, or tends to deprive any one of his rights, This is the only substantial distinction between cases of unfair competition, or passing off actions as they are called in England, and cases of infringement of trade-marks"

This subject is so large and far-reaching that we can touch upon it here only in the most general way, and as incidental only to the question of trade-marks.

Unfair competition, so far as trade-marks are concerned, may take various forms, the most common of which are discussed in the following.

Plain Bare-faced Theft of Trade-marks.

In certain lines of business, notably the liquor, wine and cigar trades, this sort of infringement is very common and organizations of houses dealing in these products have been forced to check it. Many States have enacted laws making the counterfeiting of a labor or a trade-mark a penal offense. Under the Federal law, infringement is not a penal offense, and only civil actions may be brought under this statute.

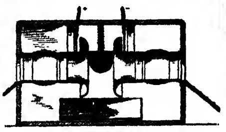
One of the most interesting cases of the adoption of a trade-name belonging to another that has appeared in the Federal courts is that of Wolf Bros. v. Hamilton Brown Shoe Company (165 Federal Rep., 413). Wolf Bros., shoe manufacturers of Cincinnati, had established a common law right to the use of the name "American Girl" as applied to shoes. This mark is not registrable, as it is both geographical and descriptive. The plaintiff has used the mark continuously since 1896. In connection with the wording, there is a lady's head and the phrase: "A shoe as good as its name." Certain styles are designated by numerals, such as 404, 408 and 397. The defendant, a St. Louis company, began to use in 1900 as a trade-mark for shoes, the words "American Lady," with a lady's picture Later on they advertised "American Lady" shoes with the phrases "With the character of the woman" and "The shoe deserves its name" The numbers used by the complainant in designating styles were also taken by the defendant. The defendant, one of the largest shoe manufacturers in the country, advertised the "American Lady" shoe extensively, spending more than one hundred thousand dollars in publicity after suit had been brought by the complainant. On trial of the complainant's suit for damages, brought before the U. S Circuit Court, the defendant's treasurer testified that objection to use of the name had been formally made by the complainant in 1901, but that he had considered a protest from a source so insignificant as something of a joke, and had paid no attention to it. The only difference is the use of "Lady" in the defendant's mark instead of "Girl;" the two being in all other respects essentially the same. Judgment was awarded the complainant The defendant was forbidden to use the "American Lady" mark, and was ordered to turn over to the complainant all profits since the suit begun.

(To be continued.)

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC RAT EXTERMINATOR.—J. W. M. CARMICHAEL, 831 Commerce St., Wellsburg, W. Va. This exterminator is simple and cheap of construction, and one, which, by means of an electric circuit arranged to be automatically closed by the animal as it passes into and through the apparatus, will

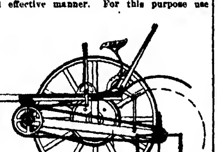


ELECTRIC RAT EXTERMINATOR.

kill the rat. A further object is to construct the apparatus so that the rat as it is killed will fall from the entering passage, and in which the circuit will be automatically opened preparatory to another operation. The engraving shows a longitudinal section view through the apparatus

Of Interest to Farmers.

GROWTH DESTROYER.—H C. SHUBERT and C. L. EVINGTON, Richland, Mo. This invention pertains to agricultural machines, and the aim is to provide a growth destroyer more especially designed for use on land that has been cleared of timber, to destroy the sprouts or returning second growth in a very simple and effective manner. For this purpose use

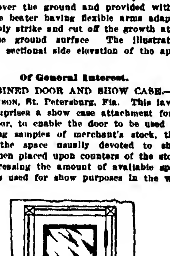


SPROUTS OR GROWTH DESTROYER.

is made of a wheeled vehicle adapted to be moved over the ground and provided with a revoluble beater having flexible arms adapted to forcibly strike and cut off the growth at or near the ground surface The illustration shows a sectional side elevation of the apparatus.

Of General Interest.

COMBINED DOOR AND SHOW CASE.—A. L. JOHNSON, St. Petersburg, Fla. This invention comprises a show case attachment for a store door, to enable the door to be used for exhibiting samples of merchant's stock, thus saving the space usually devoted to show cases when placed upon counters of the store, and increasing the amount of available space which is used for show purposes in the windows. By using glass in the construction, the articles on exhibition can be viewed through either the front or back and articles on the lower shelves can be seen through the upper ones on account of the transparent nature of the material of the shelves. The engraving shows a rear elevation of a store door, with a show case in place thereon.



COMBINED DOOR AND SHOW CASE.

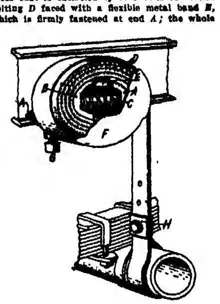
Hardware and Tools.

LINE HOLDER.—G. M. VROOMAN, 113 Fairview Ave., W. New Brighton, S. I., New York. This holder is for use in shingling roofs, and at other localities where it is desired to mark off a series of parallel lines. A series of lines may be marked off across a surface by operating on one side only of the surface. It may be operated from a distance, and the marking line changed from one location to another without making trips across the marked surface in order to regulate or actuate the device

ICE CREAM FREEZER.—H. JURGENS, 420 Fifteenth St., Denver, Col. The intention here is to provide a stationary can into which the cream may be fed continually without interrupting the operation of the movable parts, and further to provide in addition to the ordinary form of dasher and agitator for the ice and bran.

Pertaining to Vehicles.

REBOUND SNUBBER.—CLAUDE H. FOSTER, 1407 E. 40th St., Cleveland, Ohio. This device prevents breakage and excessive rebounding of automobile springs. The circular base is divided into halves, *A* being clamped to the frame of the car and *B* being movable, supported on a stud in the casting *A* by a sleeve, around which is a coil spring *C*. This two-piece base is encircled by four coils of Balata belting *D* faced with a flexible metal band *E*, which is firmly fastened at end *A*; the whole



REBOUND SNUBBER.

being inclosed in a dust-proof steel case. Springs move downward uninterruptedly, but excessive upward movement is retarded by friction and the car is kept from excessive swinging up and down. The device shown herewith is now in general use.

FOUR WHEEL DRIVE.—F. P BERGMAN and H. CLARKE, Cherokee, Okla., care of S. R. Roth, Cherokee, Okla. This invention is an improvement in four wheel drive mechanism, and has for its object the provision of a simple mechanism by means of which power may be applied directly to each of the wheels of a vehicle, without interfering with the turning of the vehicle.

TRACTION WHEEL.—J. BEARD, Veterans Home, Laytonville, Cal This invention refers to wheels for use with road locomotives, traction engines, agricultural implements, etc., and more particularly to a wheel of the above class, which comprises a revoluble rim having radially movable feet, a series of freely movable guide rollers adapted to be engaged by the feet, and arranged to permit a plurality of the feet to come into contact simultaneously with the ground.

SPRING WHEEL.—G. DOERFEL, 2816 E. 27th St., Fruitvale, Oakland, Cal. This wheel employs two elements, one movable relatively to the other, and one of these elements comprising a hub and a bearing ring rigid relatively to each other and spaced concentrically apart; the other comprising two annular members concentric to each other and also spaced apart and acting as a unit, and spring connections of various kinds from one of these elements to the other.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

Inquiry No. 9267. Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9272. Wanted names and addresses of engravers and mounters of fine quality maps or plans of large cities. Large order.

Inquiry No. 9273. Wanted to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9274. Wanted the name of a manufacturer of a machine to make cushion covers for fruit crates.

Inquiry No. 9275. Wanted name and address of manufacturer of stock patterns of plated job printing presses.

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00.

Inquiry No. 9277. Wanted a machine for packing dry batteries.

Inquiry No. 9278. Wanted a machine for separating crab meat from the shell.

Inquiry No. 9279. Wanted a machine for shredding asbestos board.

Inquiry No. 9280. Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears.

Inquiry No. 9281. Wanted to buy machinery for [illegible] walnuts and ivory nuts.

Inquiry No. [illegible]. Wanted name and address of manufacturers of coin-controlled gasoline-dispensing tanks for automobile use.

Inquiry No. [illegible]. Wanted name and address of dealers in powdered Cocoa and Kola nuts in bulk.

Curious Megalithic Monuments of France

(Concluded from page 180.)

The dolmens and roofed alleys of France appear in two forms; either entirely uncovered, or covered partly or wholly by mounds composed of stones, of earth, or of alternate layers of each. Sometimes the base of the mound is surrounded by a circle of stones to keep the mass of earth in place. The orientation of these monuments is very variable. The entrance may be directed toward any point of the horizon, although according to M. Cartailhac it faces the east in the majority of southern dolmens. A flat stone, sometimes provided with a circular, oval or rectangular appature, served as a door and protected the tomb from violation.

To these prehistoric monuments are attached legends and superstitions which are reflected in the popular names of the monuments, Fairies's Rock, Devil's Stone, Giant's Tomb, etc. The Celts and Gauls, impressed by the huge size of the dolmens and menhirs erected by their predecessors, ascribed their construction to gods and heroes, and at a subsequent period the Gallo-Romans saw in them the intervention of Saints. In Gargantua's Tooth, Gargantua's Quoit, Saint Martin's Stone, and others, may be fouud remnants of the old worship of rocks, of which traces are preserved in all Pagan religions. Even Christianity failed to eradicate these beliefs, to which the rural population of Gaul long remained faithful

These megalithic monuments must not be confounded with natural stone monuments, especially the rocking stones, which can be set into oscillation by a touch of the finger. Fig. 2 shows one of these stones, which is situated near Boussac. Contrary to old-time opinion, these rocking stones are simply freaks of nature, involving no human intervention.

A menhir is a crude monolithic pillar, a straight row of menhirs is called a colonnade and a ring of menhirs is called a cromlech. According to M. A. de Mortillet the whole number of French menhirs, including those of the colonnades and cromlechs, is 6,192 The distribution of the menhirs does not correspond to that of the dolmens. Both abound in Brittany, but few menhirs are found in the southern departments which are rich in dolmens.

The menhir of Locmariaquer (Morbihan), which attains the height of 67 feet, is the most remarkable of all. Unfortunately this colossal needle of granite was overthrown, probably by a stroke of lightning, and broken into five pieces, four of which are now lying on the ground. The original weight of the menhir is estimated by some writers at 250 tons, by others at 347 tons. At all events, this was the highest menhir in France. The second in rank, that of Plésidy (Côtes-du-Nord) is only about 37 feet high. A menhir of about 36 feet stands at Plouarzel (Finistère) and one of 34 feet at Louargat (Côtes-du-Nord). The remaining menhirs of Brittany range from 16 to 30 feet in height. Those of Lampary (Fig. 4) and Chênat (Fig. 1), represent the average dimensions. The menhirs of southern and central France are much smaller. That of Davayat, the tallest in Auvergne, is only about 15 feet high

The purpose for which these monuments were erected is still a mystery. Some archæologists regard them as primitive idols, others as monuments erected in commemoration of great historical events. It is quite possible that different menhirs were erected for very different purposes. The gigantic needle of Locmariaquer and the little menhir of six or ten feet in height have little in common with each other. Some of the menhirs may be simple boundary marks, which have no religious significance.

The large menhirs, however, are probably religious monuments. The strange practices which have grown up around them in the course of ages, and which still prevail in some districts, are survivals of ancient religious rites. After

the introduction of Christianity into Gaul, the missionaries, not daring to overthrow these ancient sacred stones, surmounted or marked some of them with crosses.

The most celebrated colonnades are those of Carnac (Morbihan), which extend a length of 19 miles from east to west. They are distributed in three groups, separated by vacant spaces, and designated by the names of the villages of Ménec Kermarie and Kerlescan. The Ménec group comprises 1,169 menhirs, arranged in eleven colonnades and one circle or cromlech. The Kemarie group contains 982 menhirs arranged in ten rows, and the Kerlescan group contains 579 menhirs, of which 39 form a cromlech and the rest are arranged in 13 rows. North of Carnac are extensive colonnades, consisting of 1,120 menhirs arranged in 10 lines and covering an area of 6,900 by 210 feet. The colonnades of Plouharnel, Peumarch, etc., are much smaller.

In other places cromlechs are found isolated and not connected with colonnades and avenues. The most typical monuments of this category are the twin cromlechs of Er-Lanic (Morbihan). The two cromlechs are tangent to each other, and one is now partly covered by the sea, even at low tide. The diameter of the imperfect circles varies from 180 to 197 feet. The numerous polished stone hatchets, pieces of crude pottery, granite millstones and primitive tools found in this vicinity indicate that these cromlechs served some other purpose than the retention of funeral mounds. Many hypotheses have been formed in regard to the purpose of the colonnades and cromlechs. Are they temples of the sun, places of sacrifice, or commemorative monuments? The study of their architecture and of the traditions attached to them will possibly solve the problem some day, but at present serious archeologists are content to classify and compare these remarkable prehistoric ruins, without indulging in fantastic conjectures.

Smoke, the Destroyer

(Concluded from page 181)

draperies and paper are soiled much more quickly in a smoky city than elsewhere. If light paper is used in covering the walls, it must be cleaned every six months and new paper put on every year to keep it looking only half as well as one would wish.

The acid in the soot attacks draperies, rendering them useless in a short time. The extra wear of cleaning materially shortens the life. On interior painting the effect is not as marked because cleaning is done about every so often anyway. But the problem of interior decoration and keeping the outside of a building clean is a problem, indeed, and next to an impossibility in some smoky places. The statement has been made to me by a number of painters that they have done jobs which looked really as bad after two or three days as they did before they were painted. Soot certainly destroys the æsthetic value of paint very quickly. The time which it takes to accomplish the pollution is, of course, dependent upon the amount of soot in the air, the color of the paint, the tar in the soot, etc. The number of paintings required to keep the same building as presentable as in a smoke free city will naturally vary greatly. Cases can be cited where it is necessary to paint three or four times as often as would be required for protection. In the majority of cases in smoky cities the amount of painting is probably doubled. Sometimes it is necessary to remove the soot and the tar and to wash the building before applying the next coat of paint. This washing also removes the paint, often making necessary two coats in place of one for a proper covering. After the wood has received ten to twelve coats it is customary to burn off the paint. This is an additional expense and likewise endangers the house by fire. The action of soot on the wearing qualities of the paint also depends on many factors, involving the chemical composition of the paint and the soot. The soot may be acid, neutral or even slightly alkaline. Places are known where the soot in reality acts as a protective coating, and this is probably the case for the most part. Others claim that it is corrosive to the paint surface, destroying the gloss and rendering it much more easily weathered. This is probably true in those cases where the coal burned contains a lot of sulphur and the soot is consequently very strongly acid.

Feeding the Body With Electricity

AT the Science Advancement Congress, held at Bordeaux, Prof. Bergonié brought out the somewhat startling fact that the electric current can serve to some extent in the place of nourishment for the human body. Should this idea be carried to its fullest limits it may be possible to dispense with taking food and simply remain for a few minutes in a high-frequency electric cage so as to have the body saturated with what might be called electrical nourishment, or in more accurate language the electric currents act to restore energy to the human body in a manner which is analogous to the effect of food. When high frequency currents first began to be used, as Prof. Bergonié says, it was shown by D'Arsonval that these could set up very striking heat effects in the organism, so that the human body is internally heated. Owing to their harmless action, no other effect than development of heat is produced. The liver, heart or brain can receive the high-frequency currents without any bad effect upon their working. Thus the current can supply as large an amount of energy as is desired to the human body, provided the heat is not brought too high so as to cause death of the protoplasm as occurs in Dr. Doyen's electro-coagulation method. But it is not hard to keep within the proper limits, and no danger need occur. With some organisms which are weakened on account of their being deprived of nourishment for any cause, the general temperature may become lowered even by two degrees. A person can thus lose a quantity of heat which is represented by one twelfth of the daily ration of that organism. It is, therefore, a wonderful result to make up for this deficit without calling upon the digestive organs and without increasing one's daily ration, also without introducing any drugs into the blood or tissues. Electricity allows of sending a quantity of energy which may be considerable into the living organism under the form of high-frequency and low-tension currents, and this action can be repeated as often as is needed. He finds that in experiments made at the Bordeaux college, overworked or enfeebled persons, anemics and the like, showed that the current caused a toning up of the system and abolished stomach overwork. Force reappeared and he found a considerable gain in weight. Commenting on this, he remarks that we once thought that chemistry would solve the problem of food, and that we could be nourished by chemical products. But this does not appear to be realized even in this age of progress. Perhaps electricity will now be able to come in where chemistry failed, and in the future ages we will be electrically fed.

Military Aviation Abroad

By the Paris Correspondent of the Scientific American

A BERLIN correspondent of the Paris daily journals states that Prince Henry of Prussia is engaged upon an aerial mitrailleuse which is being worked with in secret, but some of the details are known at present. The mitrailleuse is mounted upon an aeroplane so that it can be aimed directly by the movement of the latter, being placed in front of the pilot's seat upon the framework. It is thus aimed by raising or lowering the aeroplane as a whole by using the rudder, and a side displacement is secured in a like manner. A single pilot thus serves for flying as well as firing, and the recoil takes place always according to the direction of flight so that there is no danger of capsizing. It appears that this is the

result of a programme which the German army has been engaged in following for some months past. Armored aeroplanes are being built and great attention is given to this point, although but little information has transpired. It appears that the army recognizes that the number of its pilots is much less than in France or Russia, and to counterbalance the inferiority in the number of aeroplanes which can be put out, if this statement is to be believed, the army intends to make this up by quality if not by quantity. Eight of the most experienced pilots are selected, and they will have special aeroplanes which act as destroyers and not for scouting purposes like the enemy's flyers. The destroyers will be very rapid and will carry mitrailleuses and other arms with ammunition. In order to make a quick flight they will be fitted with powerful motors of 130 or 140 horse-power, and to avoid shot which might carry as far as 1,500 feet as experiments showed, they will have armor plated parts especially around the pilots, motor, tanks, and steering gear. The armor is heavy enough to stand shot fired as close as 600 feet. According to the programme, the enemy's aeroplanes commence to reconnoiter the front of the German lines. Thereupon the armored aeroplane takes its flight, and as it makes a higher speed of 70 or 80 miles an hour, while the enemy makes only 50 miles an hour, it reaches him after a short pursuit and seeks to destroy the aeroplane. When this is done it comes back to headquarters and is ready to begin another attack.

Admitting that the information about the armored aeroplane is correct, there may be made some exceptions to the above statements. On one hand, it is claimed that the German army will be able to put out as many aeroplanes as the French, and should this be true, the addition of the "destroyers" will give them an advantage, at least for the time. However, it is stated that ordinary aeroplanes will be able to make as high a speed as the destroyers, so that they will be out of danger. The Russian army, in fact, ordered about 100 aeroplanes from the Paris Nieuport establishment about the first of the year, these being of the two-place type, and will be used for scouting purposes. They are to make a speed of 75 miles an hour, so that even should the German aeroplanes have a slightly greater speed, they will not reach the enemy before he is ready to alight in a safe place. Again, the Russian army is also engaged in building aeroplane destroyers of a similar kind, and have already ordered a number of these from a French construction firm.

Salving the Steamer "Jose"

(Concluded from page 178.)

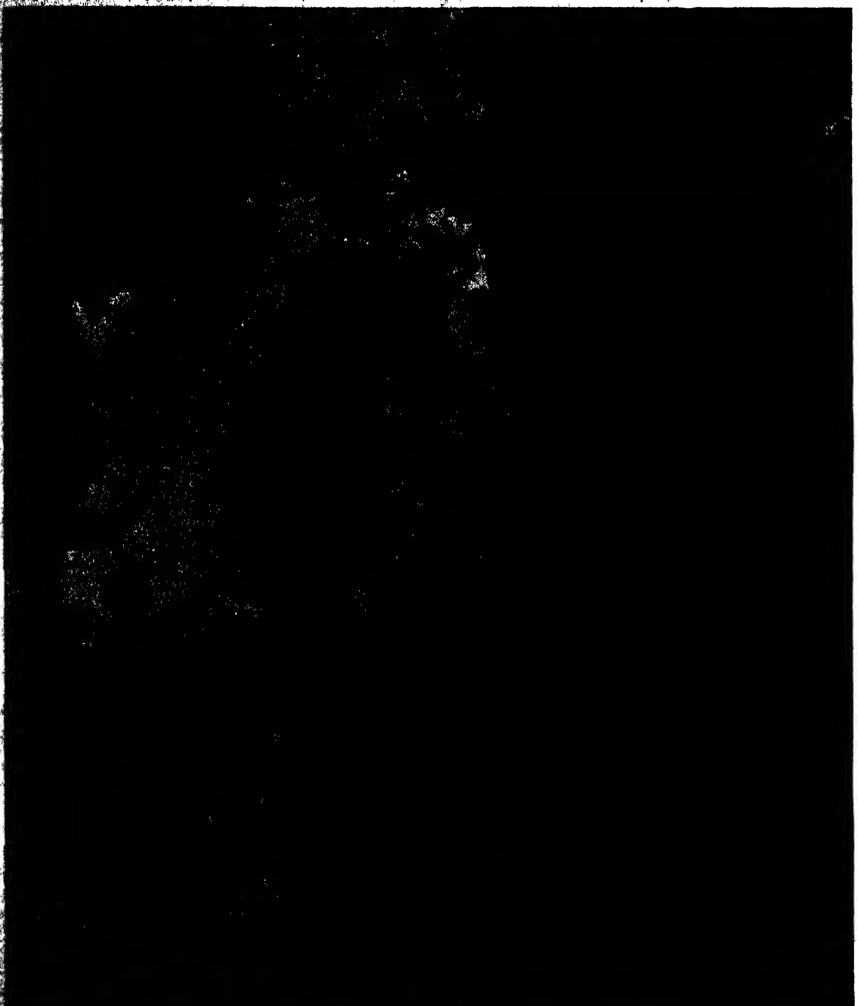
under the "Jose" was a long, tedious and difficult one, that of raising the vessel after the chains had been passed under it was far more delicate and required a great deal of skill based on long experience in such work. The tension on the chains had to be regulated to a nicety so that each would bear its own share of the burden, and here is where the practice of years in wrecking showed itself. No instruments were employed for testing the tension on the chains. Practical judgment and experience alone were used. To raise the wreck the pontoons were filled with water, sinking them as far as practicable, and at low tide the slack of the chains was taken in and their tension adjusted. Then as the tide rose the pontoons were pumped dry, and with the combined lift of the pontoons and the tide, the vessel was raised out of the pocket in which it had lain and was towed off. When it grounded the wreck was allowed to rest on the bottom at high tide, and at low tide the pontoons were filled again, the slack in the chains was taken up and then with the rising of the tide the pontoons were pumped dry and the vessel was lifted enough to carry it farther. This process was repeated until the decks were clear when the divers entered the vessel, and closed all the ports. Then the ship was pumped clear of water and floated.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

[illegible] NEW YORK, SEPTEMBER 7, 1912. [10 CENTS A COPY $3.00 A YEAR



[illegible] the head in clay of the Black Hawk Statue.

HOW A HUGE STATUE OF THE AMERICAN INDIAN WAS BUILT.—[See page 19[illegible].]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, SEPTEMBER 7, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid.	3.75

The Scientific American Publications

Scientific American (established 1845)	per year,	$3.00
Scientific American Supplement (established 1876) .	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The New Dispensation or Development of Children by Environment

EUTHENICS, the sister science of eugenics, deals with race improvement through environment. It studies the hygiene of the present generation, while eugenics deals with race improvement through heredity for future generations.

Euthenics teaches us that diseases themselves are not inherited, but the power to resist disease is inherited, and unless this resistance is present a child is liable to fall a prey to the ever present microbe.

Heredity and environment taken together produce a child's characteristic health, and as heredity is nothing more than stored environment, every mother has a chance to add to that store, so that her child's health can be better than his parents.

The following principles are used to encourage the mother whose child has one parent with a bad heredity:

1. The inheritance from the healthy parent is stronger than the inheritance from the diseased parent.

2. A bad inheritance can be overcome by a good environment.

A mother, whose child has tuberculous inheritance, should take great precautions to prevent him from contracting the disease. First, unless she be tuberculous she should nurse him herself.

Cows milk is the source of fully one half of the cases of intestinal tuberculosis in children, and when this disease is contracted under one year, it is nearly always fatal. The greatest cause of infant mortality is due to the souring or growth of microbes in milk in hot weather.

Many physicians prescribe an artificial milk food for children which requires only the addition of water, to prevent infection. The best way, though, is to avoid milk, unless you are perfectly sure that the cows have been tested for tuberculosis, and unless the milk is germ free or has been pasturized or sterilized.

A child's general diet at infancy, should be beef juice and orange juice in increasing amounts, from a few teaspoonfuls to several ounces from eight months on. From two and a half to three years he should have meat, which is finely scraped, well-mashed potatoes, and stewed fruits. The child should not have a diet composed largely of cereals or starches, for such a diet cannot supply the strength which a child needs for him to develop into a strong man or woman.

Next to the food, comes fresh air. The child should take all his naps out of doors, and at night a window should always be open, but without too much moving currents of air.

As the child grows up he should have out-door games, because such amusements bring appetite, health and sleep.

The next important thing is to prevent contagion. A nurse girl, who has tuberculosis, should never be put in charge of a child, and the child should never be kissed on the mouth, no matter by whom it may be.

All children should be taught to be clean—to prevent all diseases, but especially tuberculosis. The finger nails and hands should be kept especially clean. He should never use a drinking cup that another has used or even a glass that has been fingered.

The Half-mad

INSANITY has been variously defined in different eras and from many viewpoints—those of the scientist, the physician, the lawyer, the psychologist, the philosopher, the man on the street. And little wonder, considering the almost infinite complexity of human psychism. Besides, to define insanity with precision one must first answer the question "What is mind?" Who has ever done that successfully!

All gradations of the perturbed have been made, from the lovably daft to the hopelessly demented. And the point of view has, in the course of civilization constantly been changing. That of the present day is quite ultra-scientific, having been developed from the "rationalism" of Voltaire in the eighteenth century; it is a finding which will certainly be modified by future generations. For it considers many insane, or at least half-mad, who in other ages were rightly lauded as geniuses, saints, benefactors and world-compellers. It ignores the legendary, which is so fundamental in human nature, and so dear to humanity; it takes no account of the emotional, the poetic, the soul-stirring—entities, which after all make living the most worth while.

Prof. J. Grasset, of the University of Montpelier, has in his book "Demi-fous et Demi-responsables," designated as half-insane (Lombroso would have deemed them afflicted with "genius-insanity") such men as Pascal, Comte, Balzac, Hugo, Molière, Wagner, Schiller, Descartes, Cromwell, Goethe, Mozart, Byron, Tolstoi, Ampère, Dante, Columbus—even Shakespeare—and many another. Obviously, when one considers such men *demi-fous*, there is something wrong with the definition. Did St. Paul or St. Francis see visions? What would civilization be if they had not? Did Beethoven "rough-house" the homes of his princely friends who sought to relieve his needs? What matter to any one who has heard the Ninth Symphony? Was Caesar an epileptic? Was Napoleon a degenerate and a hypochondriac? Was poor Chopin's immortal music tinged with the toxemia of his consumption? Was Poe an alcoholic? Schopenhauer a misanthrope? Did Newton abstractedly stick his *fiancée's* finger into his lighted pipe? (He died a bachelor.) Did Dr. Holmes' neighbors doubt his sanity when he put out (so it is chronicled) a sign "Small fevers thankfully received?" Darwin used to surprise his friends by starting all sorts of apparently crazy experiments. Of what matter all these things; of what use to call such men as these neurotics, or hysterics or *demi-fous?* Where would humankind be to-day had not they, and such as they, lived? Who would not, if he could, be in such company?

Grasset most wisely refuses, as is generally done, to divide humanity into two hard and fast groups, the sane and the insane; the group which is or should be placed in confinement, and that which confines it. Part of his work is given to the discussion of Semi-responsibility, Limited Responsibility and Attenuated Responsibility, to the end that such distinctions may find place in French jurisprudence. It seems they have already been accepted in many continental courts, though not at all in our own or in those of Great Britain.

Limitations of the Aeroplane

SURFACES are measured in square feet; volumes in cubic feet. An aeroplane is a surface horizontally driven through the air. The amount which it can support varies with the speed and with the area of that surface. An increase in the weight to be supported necessitates a considerable increase in the area of the supporting surface. Although the cubical contents of the weight may increase only slightly, the number of square feet in the supporting surface may increase considerably. For the present at least there is a limit to the size of supporting surfaces. As it is, the difficulty of properly securing and holding in place the wings of a modern monoplane is such that there is little, if any, room for that factor of safety which is considered so essential in the construction of bridges and tall buildings. There is good reason to believe that some of the most serious accidents which have occurred in the last year have been due to the collapse of improperly supported wings.

Great loads, as the history of transportation teaches us, can be economically carried only by great machines. That is the lesson taught by the modern 40,000-ton steamer and the 425-ton locomotive. Small crews, controlling machinery of enormous power, are able to guide gigantic loads safely to their destinations. At present the aeroplane is piloted as a rule by one man, and it carries one or two passengers only. For that reason, if the aeroplane of to-day were to be used for passenger transportation, an exorbitant fare would have to be charged. Only by increasing the size of the aeroplane vastly will it be possible to use it as a means of commercial transport; and that increase in size is impossible because of the difficulty of increasing the size of the supporting surfaces and of [illegible] them by present methods.

Although it is impossible to [illegible] machine having a supporting surface [illegible] for commercial purposes, [illegible] time a thousand small aeroplanes so as to form one immense supporting surface. The one thousand motors of these machines would be distributed evenly over the whole surface and the one thousand propellers, each connected with its own motor, would be placed above and below the combined surface. In this possible increase of size the designer would be confronted with the necessity of placing the one thousand rudders all along the rear edge, and the further necessity of placing these rudders not only along the rear edge, but at a considerable distance back, and of supporting them in suitable framework. Difficulties equally formidable would arise in properly disposing of and providing operating means for the wing tips.

It is not inconceivable that one hundred, and possibly more, passengers might be carried by a machine thus constructed. It is probable that the conglomerate machine would rise from the ground and fly for some time on a perfectly calm day. To start it, however, would be no easy matter. No doubt it would be necessary to mount the machine on a series of small wheels running on many parallel rails. Landing would not be out of the question in a perfect calm; but in a breeze it might be fraught with disaster. Even in slightly disturbed air such a combined machine would not be absolutely safe. So huge would be the supporting surface that the air pressure would not be evenly distributed. Stresses might be set up which might well break the machine in flight.

Imagine in place of this huge combined surface a flock of aeroplanes flying closely together in the same horizontal plane, assuming that the wash of the propellers would not interfere. A gust which happened to strike the aeroplanes of one side only would raise them above the horizontal plane in which they were all flying. If the flock of aeroplanes were rigidly connected, it is manifest that the connections would snap. It is apparent that an aeroplane's carrying capacity increases in proportion to its surface, and that the engineering safety of a flying machine decreases in exact proportion to the surface exposed to the wind.

None of these objections applies to the dirigible airship. There is no engineering difficulty in constructing a gas bag of any size. Indeed, the same advantages that can be claimed for the large steamship and the large locomotive can be claimed with equal force for the large dirigible. Even now, when the cost of constructing and operating a dirigible is alarming, the advantage is all with the gas bag when it comes to carrying loads cheaply. All the resources of modern engineering can be employed in the airship to obtain great strength with very little weight. As the linear dimensions of the airship increases, its surface decreases in proportion to the lift. The impossibility of increasing the vertical dimensions of an aeroplane without increasing weight that has no lifting effect, confines the engineer to an extremely shallow girder depth, which is the real reason of the aeroplane's frailty. On the other hand, the dirigible, with its great girder depth in every direction, for the same proportionate weight can be made remarkably strong. In a dirigible size counts in every direction; a linear increase up and down means just as much lift as a linear increase fore and aft, or right and left.

If it were possible to build an aeroplane of great size without materially increasing its weight and frailty, it would be possible simply to carry many passengers with a few trained pilots and to fly somewhat faster and for somewhat longer periods than is at present possible with a small machine. In a very large aeroplane the load can be cut down, to a certain extent, in favor of more powerful motors and more fuel. In the small machine this would be equivalent to amputating legs and arms. In stability, safety and navigability, aeroplanes gain by a comparatively moderate increase in size, which might render it possible to carry in comfort several pilots, engineers, and motors, and to install elaborate controlling devices and navigating instruments. The possibility of increasing the size, however, is soon brought to a definite limit, for the reasons given.

The Northeast Passage

BARON NORDENSKJOLD'S classic feat of sailing completely around the northern coasts of Europe and Asia, accomplished in 1878-[illegible], is likely to be repeated in the near future. As already stated in these columns, the Russian ice-breakers "Taimyr" and "Waigatsch," now engaged in a surveying expedition along the coasts of Kamtchatka and arctic Siberia, may possibly continue westward all the way to Archangel, via the Arctic Ocean. A much more elaborate expedition, however, is being organized in Germany by Lieut. Schröder-Stranz, who proposes not only to make the Northeast Passage, but to spend three or four years in the journey, carrying out extensive scientific researches en route.

[illegible]

[illegible]—[illegible] are [illegible] as [illegible] from the [illegible] wheel [illegible]. This [illegible] with the [illegible] is eventually [illegible] in constructing [illegible].

[illegible] for the Great Lakes.—It has been [illegible] a [illegible]-ton boat is being built for the [illegible] Company, which will be [illegible] horse-power Diesel engine coupled [illegible] current generator. This current will [illegible] induction motors connected to the [illegible]. The shaft will be driven at a speed of [illegible] revolutions per minute. The induction [illegible] controlled by the pilot by means of [illegible] on the bridge.

Fishing with a Trolley-wire.—The sale of large quantities of fish by dealers and peddlers in Lafayette, Ind., says the *Electrical World*, recently attracted the attention of the fish and game warden of Tippecanoe County, who, after investigation, assured himself that no seines or nets were in use in his district. Setting out to ascertain the source of the unusual supply of fish, he discovered two men near an interurban railway bridge, one of whom from time to time indulged in the extraordinary practice of striking his fishing pole against the trolley wire, after which the other would gather in a boatload of the dead and stunned fish which floated to the surface. Investigation showed that an insulated wire ran down the fish pole and dipped into the water under the bridge. The 500-volt contact with the trolley served to electrocute all fish near the wire, killing them outright, it is declared, instead of stunning them as in the case of dynamiting.

Trackless Trolleys for Shunting.—An interesting application of trackless trolleys is being made at Altona, Germany, for the shunting of freight cars. The fireless locomotives in use since 1909 will be replaced by trackless tractors operated by means of trolleys pressed by a rigid rod against a double pole overhead line. The trolley, arranged on the roof of the tractor, is designed for deviating on either side to a maximum distance of 3½ meters (11½ feet), so as to allow the tractor to travel on either track. A single overhead line thus suffices for the shunting service, and the loading of cars is not interfered with. The tractor, which is 8 tons in weight, has been designed for handling up to 6 cars with their full load at a speed of 3 kilometers to 6 kilometers (1.86 to 3.73 miles) and is worked by a 35 horse-power continuous current motor at 550 volts, driving all four wheels through a 10:1 worm gear. The coupling device is operated from the driver's stand, so that the brakeman need not pass between the buffers. The shunting line is 1.2 kilometers (¾ mile) long, and reaches as far as the boundary of Hamburg.

Telephones in the United States and Europe.—According to a bulletin issued by the New York Telephone and Telegraph Company, the United States leads the world in the total number of telephones by a wide margin. There are in the United States 67.4 per cent of all the telephones, and only 26.3 per cent in Europe. As against our seven and one half million telephones, the German Empire has but little over one million, while Great Britain comes next with nearly 649,000 and France third with 232,700. There are in New York city alone, more telephones than may be found in Belgium, Norway, Denmark, Hungary, Italy and the Netherlands combined. While Chicago alone has more telephones than France, and Boston has more than Austria. *L'Illustration*, of Paris, gives the following statistics, showing the number of telephones in seventeen of the principal cities in Europe in 1911, and the ratio of inhabitants to each:

	Number of Instruments.	Number of Persons to Each Instrument.
Stockholm	72,000	4.7
Copenhagen	[illegible]	11.4
Christiania	[illegible]	14.2
Stuttgart	[illegible]	15.5
Berlin	[illegible]	16.0
Berne	[illegible]	18.3
Munich	[illegible]	22.1
London	[illegible]	26.3
The Hague	[illegible]	30.1
Paris	[illegible]	35.7
[illegible]	[illegible]	37.9
[illegible]	[illegible]	39.4
[illegible]	[illegible]	44.4
[illegible]	[illegible]	55.0
[illegible]	[illegible]	66.5
[illegible]	[illegible]	112.9
[illegible]	[illegible]	152.0

Science

Dust Laying.—The Highway Department of the city of Leeds, England, has recently treated portions of a macadam roadway with granular calcium chloride to combat the dust. Solutions of the latter had previously been tried at greater cost and without such satisfactory results. The road is first well swept and two applications of the chloride are made on succeeding evenings of about ½ pound per yard.

A Great Reservoir for Buenos Aires.—According to the London *Financial Times* the largest elevated reservoir in the world is about to be erected at Caballito, near Buenos Aires, in connection with the sanitary improvement schemes of the Argentine capital. It will consist of three tiers of wrought-iron tanks supported on cast-iron columns embedded in heavy concrete foundations. The total capacity will be 16,000,000 gallons, and the structure will be 128 feet high, from the base of the columns to the top of the roof. It will contain 15,409 tons of iron and steel. The contract has been awarded in England.

Acid-proof Iron Composition.—Iron alloys containing a certain percentage of chromium are usually employed in the manufacture of articles and apparatus which should resist the action of acids. These compositions are, however, not absolutely acid proof. Recently the well-known German metallurgist, Prof. Borchers of Aix-la-Chapelle, discovered that by adding molybdenum to an iron composition containing more than 10 per cent chromium, in amounts of 2-5 per cent, an absolutely acid-proof composition can be obtained. It is essential, however, that the iron be free from carbon, or at least nearly so. A composition containing 35 per cent iron, 60 per cent chromium and 5 per cent molybdenum, it is claimed, remains unaffected even by hot aqua regia. This alloy has the tenacity of cast iron and can be worked like the latter. Titanium and vanadium, may be used instead of molybdenum, but the latter is preferable.

Meteorological Stations in Antarctica.—With reference to a persistent rumor of great interest to meteorologists, Mr. H. A. Hunt, director of the meteorological service of Australia, says in a personal letter: "There was some talk before the Mawson Expedition went south about establishing a permanent meteorological station on the coast of Antarctica, but what the probabilities or even possibilities are will not be known until the expedition returns and reports upon conditions down there." A much bolder plan recently set forth by Admiral Peary in an American magazine contemplates the establishment and maintenance for a year of a scientific station at the South Pole itself. Meteorological observations would be the most important part of its programme. From several other quarters come hints of the fact that there is a decided drift of opinion toward the inauguration of a campaign of meteorological observations at fixed stations in south polar regions analogous to those carried out in the arctic regions in 1881-83.

English Seaweed for Trimming Hats.—According to a recent number of the *Daily Consular and Trade Reports* a rather unusual industry along the Kentish coast has come to public attention through a complaint lodged with the Kent Fisheries Committee. The inhabitants of the Isle of Grain and the adjoining districts on the east coast of Kent, have for many years been collecting a white seaweed that is washed up along the shore, which seaweed has been used by London and provincial milliners as a trimming for women's hats. This, it seems, has grown into a profitable industry during the winter months, when farm work is not to be had. Its continuance is threatened by the practice of trawlers who attach barbed wires to their trawls and gather the white seaweed before it is ripe, selling the algæ thus collected at a very low figure. In the ordinary way, the seaweed falls off from the roots and is washed ashore but the trawls pull it up by the roots and thus destroy the source of supply, besides leaving nothing for the islanders to collect but the refuse that has been thrown back into the sea by the trawlers. It was asked, among other things, that a closed season for the weed be adopted.

The Iron Mountain of Durango, Mexico.—The Cerro Mercado, as it is called after its discover, Vasquez del Mercado, is described in a recent consular report. Humboldt pronounced it the eighth wonder of the world. The mountain rises about 400 feet abruptly from the plain, is 1¼ miles long, from a third to a half mile wide, and is practically a solid mass of iron ore, of 60 to 75 per cent iron. It is estimated that there is fully 500 million tons of iron ore above the surface of the surrounding plain, besides vast deposits beneath, probably extending [illegible] under the city of Durango. The most [illegible] concerning these rich deposits, is that all [illegible] to work them profitably have been failures for [illegible], especially the long haul to market and the [illegible] cost of fuel. The new Durango-Llano [illegible], now approaching completion, will [illegible] the problem, as it taps a timber country and the waste from timber cutting is expected to supply [illegible] to use in smelting.

Aeronautics

Delivering a Flying Machine by Air.—A Caudron biplane was recently delivered by the maker to Commander Felix at St. Cyr. The distance from Crotoy to the point of delivery was ninety-six miles, which was covered in one hour and a half at an altitude of about four thousand feet.

The Talking Machine and the Aeroplane.—A novel use was made of the talking machine recently in a Farman biplane. A passenger dictated his observations, which were made on a record of specially strong material. This was then carefully wrapped and thrown to the ground, where the record was reproduced. How successful the experiment was, we are unable to learn.

Launcher for Aeroplanes.—In patent No. 1,033,148, to W. A. Bond of Lynn, Mass., assigned to Andrew M. Johnson of Lynn, there is shown a carriage adapted to support a flying machine. This carriage swings horizontally about a vertical axis and when the desired speed of the carriage is obtained, the aviator releases the flying machine so it can be thrown off from the swinging carriage.

A Splendid Record for Military Aviators.—Lieuts. Varcin and Battini, who are among the leading military pilots of the Maurice Farman aeroplanes, recently returned to the St. Cyr aerodrome after a six months' absence, during which they were engaged in scouting work of various kinds with the Mailly camp as a center. What is to be noticed is that they covered more than 12,000 miles and took about 600 passengers on these trips, these being officers who acted as scouts. All the flights took place without any accident and the aeroplanes are in good condition.

French Wireless Experiments.—The French officers are doing some very good work with aeroplanes carrying wireless apparatus and within a recent period the results are improving. The latest experiments were made by Lieut. M. de Varennes. Mounted on a Farman aeroplane he left the St. Cyr grounds near Versailles, carrying the telegraph operator Duriveau. He made a flight to Amiens, and was able to keep up wireless connection with the starting point when at a distance of 50 miles. No doubt a greater distance could have been covered but a violent storm prevented any further work on that day. Seeing that St. Cyr lies in a deep valley, the experiment was a more difficult one.

A French Military Postal Service.—A military aerial postal service is being started in the French army, and during the first trials the results showed all that could be expected. Lieut. Nicaud, mounted on a Farman biplane with Gnome motor, taking the officer Million as observer, made a flight at 6:45 A. M. from the Verdun camp, and after a trip at a very high altitude above the country in the east of France, he made a landing at the town of Nancy which is one of the leading military centers near the eastern frontier. The officers are charged with the postal service for the army and take letters which have a special aviation stamp upon them. There is no doubt that this service will be extended in the future.

Military Aviation in Russia.—The Russian army is actively taking up the aeroplane question at present. Not long ago two of the officers made a brilliant performance. Capt. Andredi is the first to make the flight between Sebastopol, Odessa, Moscow and St. Petersburg, covering no less than 1,800 miles on this occasion. Lieut. Dibowski also made a cross-county flight of nearly the same distance, both upon Nieuport monoplanes. The war department is taking measures to have aeroplanes fly in connection with the coming military maneuvers, and they are to be used alone, without employing airships on this occasion. At the Klementieff artillery firing grounds near Moscow, aeroplanes are soon to be used for observing and reporting the effect of the firing, and at the same point tests as to firing upon aerial objects will be carried on, using kites drawn by automobiles as a mark in the first place.

The English Military Competition.—In a review of the military competition held at Salisbury Plains last August, the editor of *Flight* comments: "Some of the entrants have lost many a brilliant opportunity of impressing the authorities with the capabilities of their machines. True, the weather conditions have been exceptionally bad, but we have seen the spectacle of a whole Flying Corps waiting and watching in vain for flights which, while not in the nature of observed tests, would nevertheless have impressed the army authorities with a sense of what may be called the weatherliness of the modern aeroplane. There is a difference between taking what are really legitimate risks and staying in the hangars with an obvious idea that prizes rather than orders for machines were the main object in view." This seems to have been the chief cause for criticism. *Flight* also points out that once more the need of an efficient, trustworthy engine was brought to view. Serious motor defects prevented at least two machines from accomplishing anything noteworthy. Others were far from economical in the consumption of lubricating oil.

A Novel Use of Cement in Sculpture

How the Statue to the American Indian Was Built

By John G. Prasuhn

MANY articles of literary merit have been written on Mr. Lorado Taft's concrete statue to the American Indian, but these have not made quite clear the technical side of the question—the methods employed in the construction. The writer, as builder, has been requested to set forth in simple technical terms the methods used in the building of this—so far as the writer is aware—the first heroic cement statue, which was dedicated near Oregon, Ill., on July 1st, 1911, and which has been open to the public view and criticism ever since the huge plaster mold was taken off in the early spring.

This statue, standing on Eagle's Nest Bluff, 250 feet above the Rock River, is 48 feet 4 inches in height. Five feet of the 14-foot 8-inch pedestal is exposed. From the end of the steel reinforcing rods, 2 feet in solid rock, to the top of the head it measures an even 60 feet. The statue contains about two tons of twisted steel reinforcing rods and approximately 238 cubic yards of concrete, twenty tons of which are one-fourth inch to dust pink granite screenings for the surface, giving it the appearance of a granite statue.

Approximately 65,000 gallons of water were pumped up from the river for maintaining two steam engines, and for mixing the cement. Four hundred and twelve barrels of Portland cement were used and the mixture was as follows: for the base 1 and 5; for the pedestal and steps going down into the statue, 1 and 4; for the figure, 1 and 3, and granite screenings, 1 to 1½, mixed with a water-proofing compound.

As is customary with most sculptors, the idea of a new work is expressed in the form of a sketch model. In this case the first model was only 8 inches high. The next size was 2 feet, and the third size 6 feet. This last served as the working model. Then a system was devised by which the enlargement was made, and when finished the enlargement was an exact duplicate of the 6-foot model, increased seven times.

In locating the site, a 24-foot silhouette was built, which was found to be too small from the point of view desired. Then a light 42-foot structure was erected on a farm-wagon, and the wagon was drawn around until the proper location was established.

The site having been chosen, a square central tower was built to the height of 38 feet and anchored with guy wires. Plans for enlarging the model were drawn on the model by outlining all straight lines and flat surfaces, and numbering the points with a specially constructed machine, at the termination of these straight lines and flat surfaces. A section of the surface of the model could be enlarged on the ground and drawn up by a rope, and nailed in place to correspond to the model. After all the points were made to correspond to the plan on the working model, wire netting was used for the curves; this in turn was covered with 200 yards of burlap for a surface, the burlap being pinned to the wire with nails at close intervals.

The wooden structure covered with wire netting.

The mold suspended over the excavation.

Hoisting the temporary head with a specially constructed derrick.

A specially constructed derrick was used for the hoisting and setting of the temporary head, which had been previously modeled. This served two important purposes—that of marking the precise location on the statue, and of facilitating the joining of the piece mold of the head to the mold of the figure. After the head had been placed the figure was turned 15 degrees to the right to present a clearer profile from the bluff road. The final modeling was now done and the surface was given a thin coat of plaster to stiffen the burlap, and then a coat of clay-water to insure its release from the mold later on. Both coatings were applied with a force pump.

The mold on the figure was now made of plaster and fiber supported by four 30-foot I-beams blocked up on cribbing timbers on a level with the top of the future pedestal. Every 4 or 6 square feet of the mold had independent bracing directly from the timbers on the I-beams, with strutting, cross bracing and hoops around the barrel-like structure, tending to equalize the outward strains imposed by the cement. The structure was built to shoulder level, the piece-mold fitted to the head and neck, and the two joined together in such a way as to be interlocking and self-supporting after the head had been removed and lowered in the same manner as it had been hoisted up.

Excavating was carried on at the same time that the mold was being made. While this was being done the figure was shored up by timbers from the solid rock 11 feet below the ground level. The central tower was retained as a scaffolding until the piece-mold of the head had been fitted. The interior was patched and cleaned, and the interior of the mold was given two coats, one of wall size, and one of paraffine grease; the former to keep the plaster mold from absorbing the water from the cement, and the latter to insure its release.

The remaining scaffolding was then taken out

(Concluded on page [illegible].)

Concrete statue of an American Indian at Oregon, Ill.

Taking off the piece mold.

Chopping off the mold.

A Railway Car Driven by Gas and Electricity

A Substitute for Steam Trains Where the Traffic is Light

By the Berlin Correspondent of the Scientific American

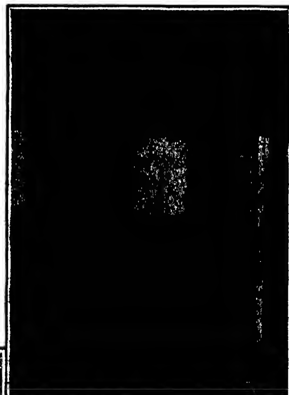
THE Prussian State Railways have for some time given special attention to the question of adopting motor railway cars on lines where there is little traffic. After carrying out preliminary trials with steam-driven motor coaches, twin storage battery cars were used on a large scale, while more recently gasoline-electric cars are being adopted.

The first car of this type was placed in commission in the year 1907. In view of the experience gained with this coach, the gas-electric set was rearranged under the supervision of Mr. Wittfeld, expert to the Ministry of Public Works. Successful trial journeys show that the new coach offers a very satisfactory solution of the question.

The car body is supported on two 2-axle bogie trucks which are provided with triple springs. In order to prevent the vibrations set up by the motor from being transmitted to the car and to insure a ready access to the generating set for the purpose of inspection, both the combustion motor and the shunt-wound dynamo employed for generating the electric current, together with its exciter, are mounted on one bogie truck.

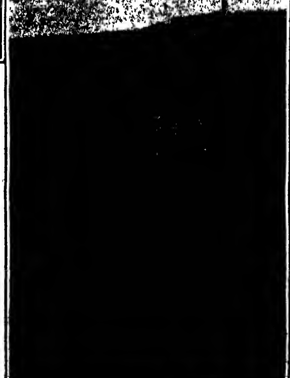
The car body, which is 10,495 millimeters in length, accommodates a total of 95 passengers in a third and a fourth class compartment, and has in addition a driver's compartment at each end. Besides the apparatus required for the control and braking of the car these compartments contain four and five folding seats, respectively, and serve for carrying heavy luggage which cannot be taken into the passengers' compartment.

Apparatus in the driver's compartment.



A new gasoline electric railway car under test on the Prussian State Railways.

A compressed-air brake of the Knorr type and a hand spindle brake are provided, both of which can be operated from either driver's compartment. The car is heated by water coming from the gasoline engine, which, before passing to the radiator mounted on the roof of the coach, flows through coils in the driver's and passengers' compartments. The gasoline engine, which was constructed by the Neue Automobile Gesellschaft, is of 4 cylinder type, and produces 120 horse-power when running at a speed of 700 revolutions per minute. The motor is under the control of a centrifugal governor, but is fitted with a device by means of which the speed at no load can be reduced to 250 revolutions per minute. This device is operated automatically from the controller. The cylinders are cast in pairs; the valves are all placed on one side and are actuated from a common shaft. The admission and outlet valves are of exactly the same dimensions and are interchangeable. The upper half of the crank-case comprises large openings at the side for inspecting the crank mechanism. The crank-shaft itself has four cranks set at angles of 90 degrees to one another, and is supported in bearings at three points. All crank-shaft bearings are placed on the upper half of the crank-case so that on removing the lower half, which is constructed of aluminium, the whole mechanism becomes accessible. A special point was made of obtaining lightness combined with great strength in order to keep the vibrations set up by the momentum of the masses as low as possible. A compressor fitted directly to the motor generates the compressed air required for braking the car and starting the motor. The current for the arc ignition is supplied by a Bosch high-tension magneto apparatus; an ordinary battery ignition is provided as a stand-by. All four cylinders are fed from a spray carbureter which draws in hot air from a pre-heater built around the exhaust pipe. All the apparatus and auxiliary mechanisms mounted on the motor, such as the carbureter, ignition apparatus, cooling water pump, compressor, etc., are so constructed that they can be removed separately after loosening a few screws.



The 120 horse-power generating set.

The combustion motor is coupled to the shunt wound dynamo generating power, by means of a flexible leather link coupling. The dynamo has a continuous output of 66 kilowatts at 700 revolutions per minute, giving 220 amperes normal current at a pressure of 300 volts; it can give 580 amperes for a period of 30 seconds. Commutating poles are provided to insure sparkless running at all loads. The dynamo is suspended in the frame of the leading bogie truck, and is totally inclosed, it is cooled artificially by means of a Sirocco centrifugal fan. The exciter current is supplied by a compound-wound exciter having an output of 2.5 kilowatts at a pressure of 70 volts, which is mounted on the extended shaft of the dynamo.

The car is driven by two railway motors, which in accordance with the regulations of the German Society of Engineers, each have an hourly rating of 82 horse-power at a pressure of 300 volts and a current of 230 amperes when running at a speed of 600 revolutions per minute. With a gearing ratio of 1:4.315, the motors are capable of imparting a maximum speed to the coach, which has a total weight of 55 tons, including the passengers, of 65 kilometers (40 miles) per hour on the level.

The connections of the electrical equipment are carried out on the Ward-Leonard system, by altering the voltage of the generator; this arrangement meets all requirements of the service in a most perfect manner. The generator can, in fact, give at starting, when great tractive efforts are required, heavy currents at a low voltage, and the exact voltage can be obtained at the generator terminals in accordance with the speed of the motor. The combustion motor thus can always be run at a practically constant load and, therefore, at the most favorable speed and with the most economical fuel consumption.

The current for lighting the interior of the car and the signal lamps is supplied by the exciter and the battery connected in parallel with it when the generator set works at full speed. At a lower speed, and in particular when stopping at stations, the exciter is automatically switched off the lighting circuit, by means of a self-acting switch, when the battery alone feeds the lighting mains. The current necessary for the ignition of the combustion motor, for the signal bell and the motor siren is taken from the battery; the charging of the battery is effected by connecting it to the exciter.

This car was until recently placed at the disposal of the chief railway workshop, and has made a number of trial journeys on the Tempelhof-Zossen line.

Recent Improvements in Electric Vehicles

A Review of Important Patents Granted Within the Last Year

IT is remarkable to note the extraordinary favor with which the electrical vehicle is being accepted in the commercial world to-day. This is due to two facts, first, the natural and inherent advantages it has, because of extreme simplicity, and second, because it is being developed and manufactured by reliable and conscientious firms who have carefully developed it, and who invariably guarantee their products.

But popular as the electrical vehicle is at present it is bound to find far greater favor as its advantages become more appreciated. Furthermore, many small improvements and some important ones have been made recently that all tend to make it a more useful and serviceable piece of machinery. These are not radical changes in design or makeup; for the very first cars manufactured are quite similar to the most improved product to-day.

The first thing that strikes one is the ease of control, due to the fact that the electric motor requires no shiftable gears and no clutch mechanism. Starting is as simple and requires no more effort than turning on of an electric fan. By the use of a controller similar in principle to that used on the ordinary street car all the variations in speed up to full speed ahead or reverse can be obtained.

The use of the electric motor does away with noise, odor and jar that is a natural consequence of use of the gasoline engine. The absence of jerks and jars gives longer life of the machinery, saves greatly on tires, and the metal parts of the frame are not subject to crystallizing and becoming brittle as are corresponding parts of a gasoline car due to the incessant vibration.

In fact the mechanism of an electric car is so simple that there are really only two things upon which there can be any extensive improvement, i. e., the battery and the motor.

As for the recent improvements in the battery, no less a genius than Thomas A. Edison, the greatest American inventor, has done much for the electrical vehicle in bringing out the nickel-iron storage battery. Edison's problem was to make a compact battery which would be of less weight and of greater capacity than the previous lead battery. The old lead batteries were extremely heavy and had to be handled very carefully as they were quite fragile and subject to many diseases of all kinds which made handling of an electrical vehicle somewhat problematical. Edison's battery is just half as heavy as a similar capacity battery of the old lead type. Hence, it is possible to carry more "battery" and to increase the m age for a single charge. Only a few years ago the mileage radius of the pleasure vehicle was not over 25 miles, now with the Edison battery it is between 65 and 100 miles.

Another improvement (patent Pieper No. 1,026,827) makes it possible to charge the storage battery while the car is descending a grade. This allows "braking" of the car without actually applying the brakes, thus saving wear and at the same time storing up energy. The control switch of this motor is so arranged, in running down hill, that the batteries are automatically connected with the motor as soon as the voltage is great enough to charge the battery.

One drawback that has often been urged against electrical vehicles has been that it is not always convenient to obtain suitable charging current. In most cities lighting circuits are supplied with alternating current, which is unsuitable for charging batteries. One ingenious inventor (Bender No. 1,017,198) has solved this difficulty. He employs a motor made of two parts. One part is in reality an alternating current motor coupled directly on the same shaft as the other part, which is an ordinary direct current motor.

By means of levers the motor shaft is disconnected from the driving shaft, and at the same time a controller switch is so conditioned that the alternating current motor can be run from ordinary 110-volt lighting circuits, turning on the same shaft with itself the direct current motor, which now becomes a generator and charges the storage battery. An automatic trip is arranged to shut off the machine and disconnect it entirely when the battery is fully charged. This invention promises to increase the field of use of the electrical vehicle, for the alternating current motor can be arranged to run on any desired circuit, but still the batteries can be charged in the usual way if desired. In ordinary use the alternating current motor acts as a fly-wheel and adds but a very little weight.

There have been developed within the last year several clever schemes to cut off the charging current when the storage battery has been fully charged. One inventor takes note of the fact that as soon as the batteries are fully charged they begin to give off gas. A rubber tube is connected with the vent of the cells and this leads to a pressure gage which opens the charging circuit when the gas pressure rises above a certain value.

Another inventor uses the increase in density of the liquid in the cells as a means for determining the extent to which the cells are charged and for cutting off charging current when the battery is fully charged.

Edison has invented an ingenious scheme to prevent the solution in the battery from passing off in gas during charging. The gas that is given off is caused by decomposition of the water. Now by putting a fine platinum wire inside the cell, and heating it while charging current is on, it is possible to cause the gases to recombine into water. Thus loss of liquid is prevented and refilling becomes necessary only at long intervals, if ever.

Another improvement of considerable note has been made in the transmission of power from the motor to the wheels. In most makes of cars in the past it has been the practice to use a chain drive. This is still most widely used on trucks and commercial vehicles, as the slight noise is of little consequence. But shaft drive is now being employed by several of the most prominent manufacturers, as it is silent and can be completely inclosed, giving a pleasing and highly finished appearance. To surpass this another ingenious inventor has patented a scheme whereby the motor is mounted concentrically with the rear axle and is entirely inclosed by the housing of the rear axle. The casing appears no larger than the ordinary differential housing on a gasoline car. The casing is made watertight and the inventor states that he can run the car right through a stream even with the wheels and motor completely under water without the least damage.

In commercial vehicles it is important to have considerable tractive or pulling power, especially where there are no pavements. This has been attended to by several inventors, one inventor has perfected a scheme whereby power is applied to all four wheels at the same time. This is arranged so as not to interfere at all with steering, and is a valuable improvement. Another inventor has added two more wheels, making six in all, and has arranged to have all of them driven, thus obtaining a great tractive effort at all times, regardless of the position of the car.

Oil-mixed Portland Cement Concrete

ORDINARY Portland cement concrete, because of its absorptive qualities, is used in some structures with only partial success. When made proof against the permeation of moisture, not only is its field of usefulness rendered more universal, but its efficiency is likewise greatly increased. A bulletin from the pen of Logan Waller Page, director of the Office of Public Roads of the United States Department of Agriculture, explains a very simple method for damp-proofing concrete by the incorporation of mineral oil residuum with the ordinary concrete mixture. It also describes the application of oil-mixed Portland cement concrete to several much used types of structures in which a damp-proofed building material will be of benefit.

While experimenting in the Office of Public Roads in an attempt to develop a non-absorbent, resilient, and dustless road material, one capable of withstanding the severe shearing and raveling action of automobile traffic, Mr. Page's investigations led him into a very promising discovery. He found that, when a heavy residual oil was mixed with Portland cement paste it entirely disappeared in the mixture, and, furthermore, did not separate from the other ingredients after the cement had become hard. The possibilities of oil cement mixtures for water-proofing purposes were recognized and extensive laboratory tests were immediately begun to determine the physical properties of concrete and mortar containing various quantities of oil mixtures.

Many valuable data have been obtained from these investigations. The damp-proofing properties of concrete mixtures containing oil have been demonstrated very definitely by laboratory and by service tests, which establish this material as one of great merit for certain types of concrete construction. It has also been shown that the admixture of oil is not detrimental to the tensile strength of mortar composed of one part of cement and three parts of sand, when the oil added does not exceed ten per cent of the weight of the cement used. The comprehensive strength of mortar and of concrete suffers slightly with the addition of oil, although when ten per cent of oil is added the decrease in strength is not serious. Concrete mixed with oil requires a period of time about 50 per cent longer to set hard than does plain concrete, but the increase in strength is nearly as rapid in the oil-mixed material as in the plain concrete. Concrete and mortar containing oil admixtures are almost perfectly non-absorbent of water, and so they are excellent materials to use in damp-proof construction. Under pressure, oil-mixed mortar is very efficient in resisting the permeation of water. Laboratory tests show that oil-mixed concrete is just as tough and stiff as plain concrete, and furthermore its elastic behavior within working limits of stress is identical with that of plain concrete. The bond or grip of oil concrete to steel reinforcement is much decreased when plain bars are used. Deformed bars, however, and wire mesh or expanded metal will reinforce this material with practically the same efficiency as in ordinary concrete.

Detecting Icebergs and Land at Sea

IN a discourse delivered at the Royal Institution after the "Titanic" went down, Prof. Howard T. Barnes, of McGill University, described some recent experiments with the microthermometer in the detection of icebergs.

In studying the effect of ice on the temperature of the St. Lawrence River, he found that the ordinary thermometer was useless, and that only through the use of exceedingly delicate electrical instruments can temperature changes be observed. To test the influence of an iceberg on the water temperature he devised a practical form of electrical resistance thermometer, capable of recording thousandths of a degree of temperature, and called a microthermometer. The thermometer coil is composed of a large size iron wire, silk covered, wound between concentric cylinders of copper. The connecting wires pass from a cable to the observing room, where a recorder gives the temperature curve and variations on a chart. The relay galvanometer is of special design, to be independent of vibration, and is exceedingly strong and quite portable.

This instrument was successfully tested in Hudson's Bay in 1910. It was found that as the ship (a Canadian government hydrographic survey boat) drew near a berg, a rise of temperature took place first, followed by a rapid fall. The effect was clearly shown on the microthermometer, but would have been missed entirely on an ordinary thermometer. Prof. Barnes calls this peculiar rise and fall of the temperature "the iceberg effect." It seems to be characteristic and easily distinguished from the small oscillations of temperature in the open sea. The rise is caused by the floating of fresh water from the berg, which water starts colder than the sea and gradually becomes warmer as the distance from the berg increases. At the fringe of this fresh water the temperature is actually higher than the sea temperature, owing to the absorption of the sun's heat. In the open sea, the warming of the sea by the sun is offset by the vertical circulation, but in the fresh and lighter water this is impossible.

During a trip from Halifax to Bristol, Prof. Barnes obtained a record of the sea temperature across the Atlantic. His instrument was placed in the circulating water drawn in by the pumps. The iceberg effect was obtained even in the water drawn from a depth of sixteen feet below the surface.

One of the most interesting results obtained with the microthermometer was the effect of land on the temperature of the sea. Whenever a vessel sails in toward the coast line the temperature is found to fall one or two degrees.

In passing over the great walls separating the shallower water about 400 miles west of the Irish Sea, Prof. Barnes found that the temperature rose sharply to a peak 1½ degrees warmer than the surrounding sea, and immediately fell again, a phenomenon possibly due to the presence of a vertical current of warm water along this wall.

A solution of the iceberg problem seems near at hand, but the greater value of a means of locating land cannot be overlooked. An exceedingly sensitive self-recording instrument, such has Prof. Barnes' microthermometer, is essential. The conflicting experiences of North Atlantic sea captains alone testify to the uselessness of individual observations. Prof. Barnes points out that it is to a knowledge of the rate and characteristics of the temperature variation in the sea, rather than to the actual temperature itself, that we must look for means by which the safety of navigation may be increased.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Dr. Wiley Defends the Bureau of Chemistry

To the Editor of the SCIENTIFIC AMERICAN:

I was surprised, and I must say indignant, at the tenor of your editorial of March 30th, 1912, in which you spoke in such a disparaging way of the young men and women who have been my assistants in the Bureau of Chemistry. As far as I am personally concerned, I never take umbrage at any kind of criticism any more than I become intoxicated with words of praise. No one realizes more keenly than I my own shortcomings and inefficiencies. I have one consolation, however, in this, that so far as I can recall, in all of the errors I may have made, I never have made one to the detriment of a consumer.

The aspersion on the ability and character of my assistants, however, I do not think should pass without a word of protest. Every person in the Bureau of Chemistry, with two minor exceptions, has received his appointment after a rigid examination by the Civil Service Commission. The total number of chemists employed in the Bureau of Chemistry at the time I resigned my position as chief was 189, of whom 106 were employed in Washington and 83 in the laboratories outside of Washington. Of this number 187 were graduates of colleges or universities. The 187 together hold 286 degrees. There are 131 B.S., 41 M.S., 39 B.A., 16 M.A., 26 Ph.D., 12 M.D., and 21 holding other degrees, making altogether 286 degrees held by 187 graduates.

These degrees are from colleges and universities in all parts of this country and in Europe. There are two from Boston University, two from Brooklyn Polytechnic Institute, five from the University of California, four from Clark University, three from the Cincinnati University, nine from Columbia, fourteen from Cornell, twenty-nine from George Washington, eight from Harvard, fifteen from the University of Illinois, two from Johns Hopkins, three from the University of Kansas, four from the Kentucky State University, seven from the Maryland Agricultural College, two from Massachusetts Agricultural College, thirteen from the Massachusetts Institute of Technology, twelve from the University of Michigan, three from the Agricultural College of Michigan, two from the University of Minnesota, thirteen from the University of Ohio, three from the Agricultural College of Oklahoma, two from Pennsylvania State College, ten from the University of Pennsylvania, six from Purdue University, four from Princeton, two from Stanford, three from Tufts, nine from the Virginia Polytechnic, two from the University of Virginia, six from Wisconsin, ten from the Worcester Polytechnic, eleven from Yale, one from the University of Halle, one from the University of Erlangen, two from the University of Göttingen, and three from the University of Heidelberg.

In addition to these, the Inspectors of the Bureau, who are not expected to be college men, are largely the holders of college degrees. Of the forty inspectors, twenty-seven are graduates of colleges.

In order that you may have an accurate idea of the nature of the examinations passed by the chemists entering the Bureau, I addressed a letter of inquiry to Commissioner Black of the Civil Service Commission, and inclose a copy thereof and of his reply. It shows the fundamental training received by the men of the Bureau of Chemistry, and the conditions under which they entered the Bureau.

In regard to the training in the Bureau itself and the work done, I would say that to a large extent, the field of food and drug chemistry being comparatively new and so extensive, we developed, in a way, a training school for food chemists, and our chief difficulty in maintaining the efficiency of the Bureau was that the work of the men was so valuable and so widely known, that they were continually taken away from us by commercial firms, who paid larger salaries than we could in the Government. This can hardly be considered an argument against the efficiency and training of the men engaged in the work, inasmuch as no one will contend that commercial interests are in the habit of employing, at high salaries, men who are not expert in their specific lines.

I doubt if you can find a more capable, more devoted, and more loyal body of college graduates, of the same number, anywhere in the United States. I feel certain that you must have made the statements you did under a misapprehension of the facts, and I sincerely hope that you will take occasion to correct the impression which your editorial has undoubtedly made.

Washington, D. C. H. W. WILEY.

[Dr. Wiley mistakes an academic degree for scientific efficiency. Whether or not the employees of the Bureau of Chemistry passed Civil Service examinations or graduated from institutions of learning is beside the point. We are concerned only with the effective administration of the Pure Food and Drugs Act, in securing the passage of which Dr. Wiley performed a conspicuous public service.

Dr. Wiley states that so far as he can recall he never made a decision to the detriment of a consumer. We would refresh his memory by citing a decision of his which was published fully in the Washington *Post*, and which permitted the use of lead in baking powder. Lead is a poison cumulative in its effect. Surely this was not in the interest of the consumer.

The mere existence of the Referee Board, appointed by President Roosevelt and composed of men of the highest scientific standing, speaks for itself. That board was created for the sole purpose of checking up the work of the Bureau of Chemistry. It has cost this country hundreds of thousands of dollars. To be sure, the idea has been spread abroad that the Referee Board is the tool of food and drug adulterators; that its existence is a menace to the public. On questions of scientific fact, such men as its chairman, Dr. Ira Remsen, are not easily fooled. Nor may one accuse them of corruption without impunity and without incurring a justified indignant protest from every scientific man. So long as the Referee Board is required to continue its critical examination of the Bureau of Chemistry's doings, so long must the Bureau of Chemistry be regarded as scientifically unfit for the task of prosecuting food adulterators.

As an example of the inefficiency of the Bureau of Chemistry we have only to cite the benzoate of soda studies. The important question of the effect of sodium benzoate was intrusted to a medical student who had not even a degree of M. D. Totally inexperienced, totally unfit for this important task, is it any wonder that his results were repudiated by such experienced and respected scientists as Lehmann, the distinguished hygienic authority of Würzburg University? Is it any wonder that President Roosevelt found it necessary to appoint a board which would conduct investigations with scientific accuracy to determine the effect of benzoate of soda? And is it any wonder that the findings of an incompetent medical student should have been reversed?

The Pure Food and Drugs Act is one of the most important pieces of legislation ever passed in this country. That it should be administered by men whose scientific incompetence is a matter of common knowledge is unfortunate for the consumers whom Dr. Wiley states he has always sought to protect.—EDITOR.]

The Scientific Feet of the Bureau of Chemistry

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in reading in your August 3d issue an editorial with the caption "Wanted—A Chief for the Bureau of Chemistry."

The article reads, in part: "Months have now elapsed since Dr. Wiley resigned as chief of the Bureau of Chemistry. That no successor has as yet been appointed may be attributed to the fact that it is no easy task to induce a scientist of commanding position and personality to accept an annual salary far less than the sum which he could earn in a year in private practice. Moreover, the conditions under which work is now carried on in the Bureau of Chemistry would be intolerable to any really scientific man."

Your statement that it is no easy task, etc., is absolutely correct, and it is on this account that the Referee Board was established—a Board composed of scientific experts whose qualifications were such that any investigations conducted by the Board would be recognized in the scientific world as well and faithfully done.

In reference to the conditions existing in the Bureau of Chemistry, I beg to say that there is less friction there now than there has been for some time, as the work is being done harmoniously.

You say, "Selfish manufacturers are bound to do all in their power to make his official life as unbearable as possible, and the spirits that now dominate the work done by the Bureau of Chemistry in passing upon the legality or illegality of the doings of the food and drug manufacturers would hardly be in sympathy with a real scientific chief."

In reference to the above assertion I beg to say that it is the manufacturers who are desirous of having experiments conducted by a truly scientific board.

You also say in part "As matters now stand, the Bureau of Chemistry has the lamentable distinction of being the only department of the Government that cannot stand on its own scientific feet, and that requires scientific supervision by another body."

In reference to the above, I beg to say that the Bureau of Chemistry never had any "scientific feet to stand on."

You also say, "At present wealthy dishonest food manufacturers find it no difficult task to escape the punishment they so richly deserve. Opposed by well meaning but incompetent employees of the Bureau of Chemistry, they find it no difficult matter in court to offset their unscientific evidence by expert testimony, which can be bought at a market price, and which is at least as good as the evidence offered by the Government."

In reference to the above statement, I beg to say that the judgments secured against various so-called "wealthy dishonest food manufacturers," up to August 3d, 1912, numbered 1,550.

Dr. Wiley, in his report on the Committee of Expenditures in the Department of Agriculture, 1910, when he was asked by the chairman, "Do you find difficulty in keeping bright young men in the department at the present time?" said: "That is the great difficulty. As soon as a young man becomes noted for his work he is in great demand, not only in other bureaus and other branches of the public service, but he is in great demand for college and technical work outside. I think the Bureau of Chemistry has lost a larger percentage of its good men than almost any other Bureau in the department. We are losing them constantly."

It was disclosed, during the Coca-cola case, that Dr. Wiley refused to testify, saying he "could not qualify as a chemist, a pharmacologist, a toxicologist, a physiologist, a physiological chemist, or a doctor of medicine either to his own satisfaction or to the satisfaction of the Government."

The above clearly demonstrates that the so-called chief of the Bureau of Chemistry could not qualify as a chemist, and that he was unable to retain good men in his employ, consequently, when truly scientific questions arose they were referred to a board composed of the best scientists obtainable in the United States.

The above are facts, and as the SCIENTIFIC AMERICAN is desirous of giving its readers scientific facts, I trust you will give them an opportunity to peruse the above.

New York, N. Y. H. L. HARRIS.

The Electric Niagara

To the Editor of the SCIENTIFIC AMERICAN:

The issue of June 29th discusses the "Electric Niagara" in France. It occurred to me when reading this article that the French may explain their procedure in such experiments as those performed by Sir J. J. Thomson and others on the effect of potential on cloud formation. Vapor seems to have a tendency to congeal if there are small particles present which form a nucleus. Such nuclei result in diminution of vapor tension and consequent cloud formation. Electric charges seem to form nuclei or accelerate cloud formation, but to my recollection the condition is a critical one.

Rain drops and hail stones require nuclei; and perhaps the French preventive methods, while they are not large enough to handle all the electricity that nature stores, may be supposed to make enough trouble to prevent the critical condition and thus prevent the formation of the starting nuclei.

Cleveland, O. J. C. BOERTLEIN.

[It is quite true that free electrons, however produced, serve, under certain conditions, as nuclei about which water vapor may condense into droplets, but the conditions are so unusual that it seems impossible for them to take place in the open atmosphere. Even the negative electron, which is a much more effective nucleus for condensation of water vapor than is the positive electron, requires (*a*) that the air be free from all dust, and (*b*) that the water vapor present shall produce at least a fourfold supersaturation. But as dust, according to innumerable observations, is always present in the atmosphere, it follows that supersaturation is impossible in the open, and therefore that no amount of ionization can materially affect either the time or amount of rainfall, hail, snow or any other form of precipitation.

From experiments and observations begun by Simpson in India, and continued by others in various countries, it is practically certain that the electricity of thunder storms, whether accompanied by hail or otherwise, is only a by-product of the storm itself and in no sense its cause. Hence to modify it either in kind or amount would be to modify only one of the things which the storm produces and not that which produces the storm.—EDITOR.]

When the Poles Attract Each Other

To the Editor of the SCIENTIFIC AMERICAN:

C. C. Kiplinger, in the issue of March 16th, cites experiments to prove "like poles attract each other." Unfortunately, it seems as though such things as "magnetic rounds" and other luxuries have ousted the old "Filings" experiments from the board. Had he tested with filings he would have found the true cause, which is a very old phenomenon, that of local "reversal of polarity," the larger magnet causing a temporary reversal in the end of the smaller, which then acts as a piece of plain iron or steel. If a steel magnet be used, and then tested, after separation, by filings, it will be found that "consequent poles" have been produced. With the electro-magnet these disappear immediately on separation. I would like to know what he means by "similarity of magnetic and pressure phenomena." HAL MCKAIL.

Kalgan River, West Australia.

Fig. 1.—Plan view of the field of force between the two poles of a magnet.

Making Models of the Magnetic Field

Fixing the Iron Filings With Plaster of Paris

By Nathan C. Johnson

THE mapping of the magnetic field of force by means of iron filings sprinkled over a glass plate, beneath which is a magnet, is a very old experiment. Faraday was perhaps the first to perform it; and his sketch of the field of force between two parallel conductors as revealed in this way is the earliest record we have of this phenomenon.

Since then, however, the experiment has been performed times without number; but its usefulness has been limited by reason of the decoherence of the filings with the loss of their form as soon as the exciting force was removed, or any unusual conditions of mechanical shock were introduced. Further, only a two-dimension map of the field of force was produced; and although it was known very soon that under normal conditions the field was of equal intensity on all sides of a central line through the poles, yet we have heretofore lacked more than transient ocular proof of this fact.

With a view to overcoming these difficulties and of determining both the form and the intensity of the field under varying conditions of polar form in such manner that the results could be studied at leisure, the experiment herein described was devised. Briefly, it consists in using a mixture of iron filings and plaster of Paris made into a paste with water and sifting this paste over the field area through a medium-mesh sieve. As the iron is carried in suspension in the paste, the mixture is attracted by the poles and the intervening stressed space in proportion to the magnetic intensity, with the result that when the mixture has hardened, due to the setting of the plaster, a relief map, or a three-dimension model of the field of force, is obtained. Photographs of models made in this manner are shown herewith.

Fig. 1 shows a three-dimension map of the field of force between the poles of a powerful electro-magnet. The magnet had square poles, but the effect of this form is not noticeable, due to the intensity of the field employed. In making this map, the procedure outlined above was followed, a glass plate being placed over the poles of the magnet and the paste of plaster and iron being sifted over the plate through a sieve. As before explained, the paste is attracted away from the natural line of fall into the lines of passage of the magnetic flux; and the more intense the field in any locality, the greater the quantity of material at that portion in the resultant map. Therefore, the elevations of the different portions show approximately the intensity of the force at that point; and the direction and inclination of the spines or points rising from the surface also indicate the form and direction of the air lines which were not intense enough beyond a short distance from the pole to hold the material in suspension. In Fig. 2 is shown a profile view of this map, which makes the relief feature more distinct.

Of course the work of applying the paste has to be done very quickly; and the paste must be of just the right composition and consistency to secure good results. Repeated failures are almost sure to be the price of the first success; but once the knack is learned, the procedure will be found easy and the results very instructive. It should also be added that an additional value is given these models by the distinctness and beauty of their color, due to the rusting of the iron, which brings out the lines of force in excellent contrast to the white plaster; and in the map under consideration, a further value is conferred by the reverse side, that which was next the glass plate, having an unusually distinct and accurate force map in two dimensions showing on its surface. This was not photographed because the figure is so well known as not to warrant reproduction.

Fig. 3 shows the field of force of a short solenoid without a core. The making of this model was a very difficult piece of work, due both to the difficulty of obtaining a field intense enough to form the paste properly without undue heating of the coil, and to the necessity of sawing the coil in half afterward without injury to the finer spines of the model. It is to be regretted that some of these have been lost, but enough remain to show the field well. The author hopes in the near future to carry out this work further and to investigate by this same means the leakage in solenoids and the field of force when using different forms of plungers.

By various methods we have long ago determined the effect of various shapes of pole pieces on the attractive power of magnets. Perhaps the first important researches in this regard were made by Dr. Julius Dub in 1850, an account of which is given in his book "Elektromagnetismus." His method of procedure was to have pole pieces of various forms and dimensions which could be screwed upon the core of an electro-

Fig. 2.—Profile of the field of force between the two poles of a magnet.

magnet. Then, with a given excitation of the magnet, he determined the attractive power of the different pole faces by noting the deflection of a magnetised needle hung some distance away by a bifilar suspension. Sturgeon and Count du Moncel also investigated these phenomena, adding to the investigations and conclusions of Dub a research on the leakage of flux with the different pole pieces. At about the same time, Von Kolke investigated flux distribution over different polar forms, and by using a small steel ball, suspended from a spring balance, he measured the pull on the ball over different portions of the polar area. The results of these pioneers have since been substantially confirmed by later investigators, using more refined methods; but it may be interesting for us to prove these results visually by means of the plaster and the iron models.

Fig. 4 shows the field of force over a large flat pole piece. The directions of the lines of force are very well shown in this model, as well as the intensity of the force, showing the great energy at the edges and the relatively small intensity at the center of the pole. This is as we would expect, for from the edges, the lines have a shorter path back to the opposite pole than they have from the center, so that there is greater magnetic density at the edges. A curious optical illusion may also be observed in connection with this photograph. If it is turned upside-down, the perspective of the photograph appears far different from that of the proper position.

Fig. 5 shows the effect of a small flat pole having an air return. By this latter is meant that the opposite pole of the magnet is a considerable distance away, and that the magnetic circuit is completed through the air, with no nearby iron return circuit to build up the intensity of the field. We see from this model that with such a pole, there is a considerable concentration of the force lines at the edge, with resultant spreading. Compared with the intensity of the center of the pole, as evidenced by the length of the spines, the intensity at the sides is much greater.

Fig. 6 shows an exaggerated case of the same kind. In this, the pole face is twice the diameter of that in the preceding, and we have a corresponding increase in concentration at the edges as evidenced by the radiation, and a very noticeable diminution of intensity at the center. It should be understood that in making

Fig. 3.—Field of force of short solenoid without core.

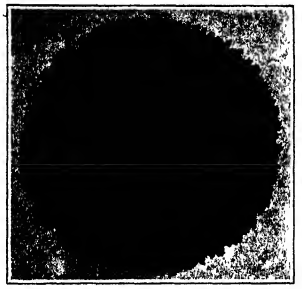


Fig. 4.—Formation over large, flat pole piece.

itself. After hardening somewhat, it was split open to show the interior structure, which should give us the force distribution over the polar face, as well as the field intensity and form. That this result has been accomplished is evident from inspection It is at once seen that the conical pole has the greater concentration of the two, with extreme density of flux from the point; while the rounded pole shows less concentration of the conical pole. The bending over of the lines of force emanating from the flat pole can be very clearly seen in this figure.

Fig. 11 shows the enlarged flat pole as contrasted with the conical pole. This model became too hard to split down the middle, but the interior is hollow for a third of the length from the flat pole, except at the edges, where the material is very dense and converges sharply toward the center. As the quantity of iron in this model is considerable, the lack of radiating spines from the edge of the flat pole may be accounted for by the formation of a magnetic short circuit through the model.

That there are certain defects inherent in these models, and in this method of mapping the magnetic flux, the author recognizes; but they are submitted in the hope that by their use some information may be gained that may eventually lead to a better understanding of some at present puzzling phenomena

Insects and Formol

IT is a matter of some surprise that insects can live in such a powerful antiseptic liquid as *formol*, which is much used in keeping anatomical preparations precisely because it kills the tissues rapidly. A German scientist, M. Schultze, states that flies of the Drosophila genus resist the action of formol in a striking way, and he observes other remarkable cases, for instance hydrocyanic (prussic) acid vapors are exceedingly poisonous and will kill moths at once, but he finds that the zygenes are able to live in it, and even to develop. Jensen states that although the liquid in the pitchers of the nepenthe plant attacks and digests insects, he finds that three culicides will live in it unharmed, and they are protected against the digestive action by an anti-ferment which they secrete Prof Korschelt saw that larvæ of the common fly, when kept in a 2 per cent solution of chromic acid, could be transformed into pupæ and also into winged flies Another German scientist, Prof. Schultze, received bottles from east Africa containing anatomical specimens preserved in formol, and he found a great number of larvæ and pupæ of the *Drosophila rubrostriata*. Fearing that they would attack the specimens, he poured in pure formol, but even this did not kill them Other Drosophila are found to live in liquids which seem unfavorable for development of life, for instance, the *Dr. funebris* and others are found wherever there are substances in acid fermentation, such as in fruits, vinegar or beer They lay their eggs here, and the larvæ find sufficient food, this consisting of spores, bacteria and fermented matter which appear at the surface of fermenting liquids The *Dr aceti* lives in apples or apricots which are in putrefaction, and the *Dr pallipes* lives in the larva state in the sap which flows from cut places in the elm tree Other unusual cases might be mentioned

Fig. 5.—Small flat pole with air return.

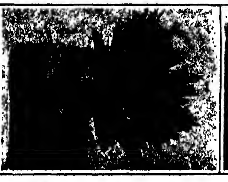


Fig. 6.—Enlarged flat pole with air return.

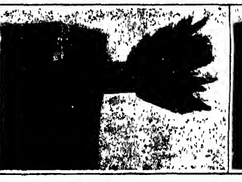


Fig. 7.—Rounded pole face with air return.

Fig. 8.—Conical pole face with air return.

these models, the same procedure was followed as in making Fig. 1; so that they virtually have made themselves, only so much of the material as we picked up by the pole itself being in the model. For this reason, their form may be considered a reasonably accurate representation of the magnetic field.

In Fig. 7 is shown a rounded pole face of small diameter. It will be seen that this has great intensity at the center and less at the sides, with only a slight tendency to radiate outwardly from the sides. This corresponds closely with what we know in regard to the effect of rounded-ended poles for electromagnets.

Fig. 8 shows a conical pole, having, as before, an air return. The extreme concentration of this form of pole is well shown by the length of the center spines and the close bunching of the whole mass around the center.

To confirm the last two results and to contrast them with each other, as well as to show the form of an intense field between two such poles, let us refer to Fig. 9. This model was formed in the same manner as were all the others, so that it, too, may be said to have built tration at the middle and a greater tendency to radiate from the sides.

In Fig. 10 the contrast between the poles is still more marked. In this case we have a small flat and a conical pole, the model having been split open as before. It will be noticed that the structure is less dense in the center than was that formed by the rounded pole, while the tendency to radiate from the edges is greater, especially so in contrast to the con

Fig. 9.—Field between rounded and conical pole pieces.

Fig. 10.—Field between small flat and conical pole pieces.

Fig. 11.—Field between enlarged flat and conical pole pieces.

A Motor-driven "Mauretania"

BASING its estimate on the amount of fuel required by the "Selandia" of 2,500 horse-power, and assuming a consumption of 11½ tons of oil per day, the *Engineer* estimates that the "Mauretania" would require 313 tons of fuel per day, or 1,487 tons for a run across the Atlantic It is estimated that if the "Mauretania" had a double hull, with one foot between the two skins, she would have storage space in her sides of about 56,240 cubic feet, which would be sufficient to contain the oil necessary to carry her across the Atlantic.

Front of the Broadway Beach tunnel building shield.

Lower part of cutting ring at the right. The dotted line shows the contour and location of the concealed left portion.

Side of the shield.

To the left and right respectively are the cutting ring and building hood. Hydraulic rams in the center space, which was originally of wood.

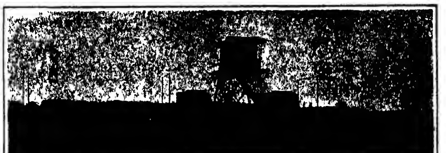
Excavating the Beach Shield

DURING the excavation in the month of August last of lower Broadway under the supervision of the Public Service Commission of New York city for the building of the new Broadway and Lexington Avenue four-track subway, the engineers had to remove the smaller tunnel, 10 feet exterior diameter, built in 1869, located under the center of Broadway, opposite City Hall Park, and extending from the south side of Murray Street to the southwest corner of Warren Street on the north.

This tunnel had been constructed under the street at that early period without disturbing the surface or the traffic over head, as described in the SCIENTIFIC AMERICAN of March 5th, 1870, by means of the Beach hydraulically propelled cylindrical shaped shield, built of wood and iron, the exterior diameter of which was of the same dimensions as the trailing tunnel of tube, or about 10 feet

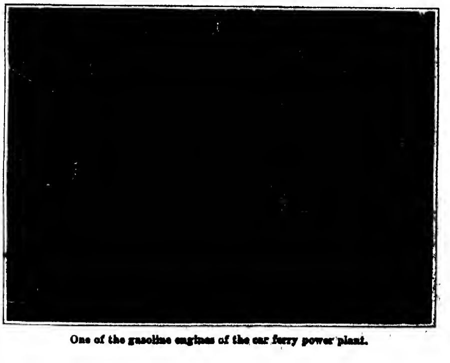
It was the invention of Mr. Alfred E. Beach, one of the original proprietors and editors of the SCIENTIFIC AMERICAN. Upon the request of Mr. Alfred E. Beach's son, Mr Frederick C Beach, now also one of the owners of the SCIENTIFIC AMERICAN, and the courtesy of the officials of the Public Service Commission, the contracting company was asked to refrain from demolishing the shield after it was dug out, with a view of its removal, preservation and restoration as a historical relic, it being the first machine of its kind to operate in tunnel construction work in New York city and the forerunner of all the great shields used in the construction of the mammoth electric railway tubes now under the rivers about this great city.

An inspection of the shield from the exterior as it lay partly imbedded in the sand, by Mr F C Beach (who actively supervised the operation of it in 1869), disclosed the fact that in all these 43 years the iron and brass work, including the thin hood of iron on the rear, had remained in pretty good condition, but the wood staves between the front cutting ring and rear ring carrying the hydraulic rams and the cross front wood shelves had entirely disappeared and rotted away. The flashlight photograph, with Mr Beach standing near the cutting edge, shows the one half of the front cutting ring with projections on its interior surface, to which was secured by bolts the ends of the thick transverse shelves for the purpose of preventing the inflow of loose sand. In the center, is observed the timbers used by the contractors to support the present street planking over head as well as the electric street railway. The side view shows the side of the front cutting ring connected by inch stay rods to the rear of the hood-ram supporting ring, and between these rods at equal distances will be observed the cylinder ends of the hydraulic rams with bent tubing on the rear, which connected with the main supply pipes from the hydraulic pump. This was operated by manual power. The long thin cylindrical hood is attached to the rear piston ring and extends back from it some two feet or more. The pistons within the rams are forced out by water pressure against the completed tunnel, built up within the hood, pushing the shield forward through the sand to the extent of the hood; then a new layer of masonry is built and the process repeated. By this method only the quantity of earth is removed that is required for the tunnel to occupy.



A full side view of the all-steel interurban car ferry "Henderson."

This car ferry has a capacity of two electric passenger cars, a speed of 8 miles per hour, and is operated by gasoline power.



One of the gasoline engines of the car ferry power plant.

Car Ferry Service Across the Ohio River

AN experiment in interurban railroad practice which has been worked out at Henderson, Ky., demonstrates the efficiency of gasoline power for use on car ferry work.

The "Henderson" is the first interurban car ferry ever built, and the first large car ferry operated by gasoline power. She is all steel; length over all, 120 feet; beam over all, 34½ feet; beam at water line, 25 feet. Her displacement when light is 88 tons, and loaded with two electric interurban cars, 150 tons.

Her power plant is two 54 horse-power "Buffalo" heavy duty gasoline engines, seven-inch bore and nine-inch stroke, with a normal speed of 350 revolutions per minute. Each engine drives one side paddle wheel, but there is additional gearing by which one engine can operate both wheels if desired. The motors drive the wheel shafts through large bevel gears at a ratio of 10 to 1. The side paddle wheels are 10 feet in diameter, three feet wide and have 20 blades 18 inches deep.

Economy was one reason why gasoline power was chosen for use on the "Henderson." While it takes her only six minutes to cross the Ohio River with the current, and an additional two minutes when going against the current, the "Henderson" is called upon to make only one round trip every hour. This means that most of the time she is standing idle at one side of the river or the other, waiting for her cars to arrive. With a steam plant this would mean a great waste, for coal would be consumed all the time the boat was at dock, but with gasoline engines, when the boat stops, the cost stops, there is no steam to keep up.

An Electric Harp

By [illegible] Williamson, Jr.

BEING possessed of a three-bar auto-harp, of which the bar mechanism had been accidentally broken, it occurred to me that it might be arranged to be played by electric power.

My first intention was to have pickers for the strings as in a regular harp, but this scheme was abandoned, as too complicated, an arrangement for striking blows upon the strings, being substituted. Some experiments showed that the simplest plan was to use solenoids, that is, magnet coils with movable iron cores. How this was managed and the apparatus constructed, is shown in the accompanying illustrations.

Upon the harp *A* (Fig. 1) were screwed two upright side pieces *B* and *B'* with foot pieces *C* and *C'* to support the instrument in inverted position for play-

The electric harp in operation. A solenoid shown in the insert.

ing. Three strips, *D*, *G*, and *I*, of 5/8th stuff, 1½ inches wide, were then cut out. The strip *D* was laid across the 21 strings of the harp, between the two uprights, and carefully marked where the strings crossed it. These marks were extended to the 1½-inch side, crossing two parallel lines drawn lengthwise on the strip, ½ an inch apart. A light mark was then made in the wood, with a center punch, at alternate points where the cross lines joined the parallel lines, "staggering" them, as it is called. At each mark, a 3/16-inch hole was then drilled perpendicularly through the wood, using a twist drill.

The solenoid coils were now wound upon 21 pieces of 3/16-inch thin glass tube, 2 inches long, the glass being nicked with a file and broken between the fingers. The winding was done thus: A bit of ⅛-inch brass rod 3 inches long was clamped in a vise, and one of the tubes slid upon it. A wooden crank was then forced temporarily on the glass, and the latter wound with four layers of No. 24 enameled copper wire, in a coil 1½ inches long. The terminals were twisted together and the ends of the coils shellacked to prevent their slipping.

The free ends of the tubes were then set in the drilled holes in the wooden strip *D*, and glued securely, after which the strip was secured between the uprights, in such a position, that the ends of the solenoid tubes E^1, E^2, etc., were one half inch from the harp strings, which show in the figure as a row of dots. One terminal of each coil was then scraped free of enamel and soldered to a common return wire *F*, terminating in a screw and washer on one of the side pieces, for a battery connection.

The strip *G* was then screwed between the uprights, close to, and at right angles with, the strip *D*. It was drilled to receive 21 round head No. 6 brass screws, one inch long, provided with washers. The screws were set in opposite sides of the strip, alternately, similar

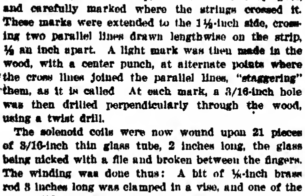


Fig. 1.—Front view of solenoids.

to the solenoids. The iron cores for the magnets were made from 3-inch wire nails of a size to just slip easily into the tubes. The heads were cut off, and both ends were filed flat, reducing the length to 2½ inches. They were then set in place in the tubes, as shown at H^1, H^2, etc., and the strip *I* upon which they were to rest, was secured between the supports, 2 inches below the strip *D*, so that ½ inch of the core remained in the tubes. The upper face of the strip *I* was padded with a four-fold thickness of canton flannel, to reduce the noise of the dropping cores. A similar strip of flannel (*V*) was glued to the face of the harp, opposite the solenoids, to cut down the reverberation of the strings.

The keyboard and music roll attachment, shown in Fig. 3, consisted of a base board *J*, 13 inches long with upright sides *K*, *K'*, 5 inches high. The rollers, *L*, *L'*, were made of 12-inch lengths of 2-inch curtain pole, with 2¼-inch heads *M*, *M'*, etc., turned from cigar box wood. They were pivotted at one end, on wire nails, driven into the centers; and revolving in holes drilled in the side piece. In the other ends were forced 2-inch cranks of 3/16-inch round brass rod *N*, N^1, revolving in open slots in the side piece to allow the rollers to be easily removed. The slots were covered with small brass strips which could be turned aside to release the

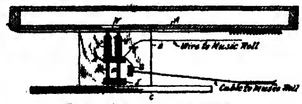


Fig. 2.—End view of solenoids.

rolls. A cross strip, marked *O*, was fastened to the top of the side pieces, just back of the front roller, and to this was secured a strip (*P*) of 1/16-inch brass 3/8-inch wide provided at one end with a screw and washer for the battery connection.

Half an inch back of strip *O* was placed a second cross-piece *Q*, of the same size as the former, but raised ½ inch above it, on small blocks. One end of strip *Q* was hinged to the block and the other held down by the latch *S*. To the narrow edge of this strip were screwed 22 strips of light spring brass R^1, R^2, etc., 1¼ inches long and tapering from ¼ inch wide at the large end to 1/16 inch at the small end. The strips were clamped together in a vise, and drilled through the wide end in one operation with a hole large enough to take a No. 6 screw. The extreme tips of the narrow end were turned up slightly to avoid catching in the music roll, and the whole set fastened by screws to the strip *Q* in such position that the small ends pressed firmly upon the cross-strip *P*, and were spaced just ½ inch apart.

The paper music was made from a strip of heavy wrapping paper, about 6 feet long by 12 inches wide. One end was cut V-shaped, the point being tacked to the center of the front roller, which was then turned over a couple of times to hold the paper firmly. The paper was then wound forward under the springs, and the notes and chords marked in pencil in a line with the corresponding springs. The bar *Q* was then thrown back out of the way and a strip of wood, sawed across the grain, was set temporarily beneath the paper at this point. This wood was 12 inches wide and 5¼ inches high, and was used as a support upon which the holes were punched in the paper at each pencil mark, using a hollow steel punch of 3/8 inch diameter. The end grain of the wood allowed the punch to sink in, making a clean, round hole. Perforation for successive notes were spaced ¼ inch apart. The harp and keyboard were connected with No. 24 enameled wire, as the distance between them was only about 18 inches. For a longer distance No. 18 or 20 wire would be required. A wire was connected to screw No. 1 on the cross-piece *D*, Fig. 1, and the other end to the screw on spring No. 1 of the keyboard. No. 2 screw on the harp was joined to spring No. 2 with a second wire, and so on. The wires were then gathered into a cable *U* and taped together as shown. A battery of two or three dry cells was attached, one terminal going to the screw on the common return wire *F* and the other to the screw on the strip *P*.

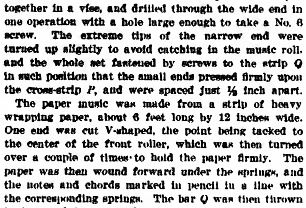


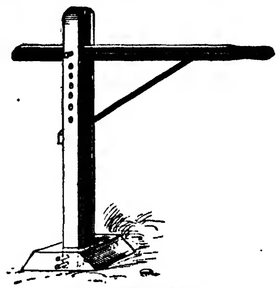
Fig. 3.—Music roll mechanism.

To operate the harp the crank of the front roller was turned to draw the paper forward, and as the perforations in the latter reached the various springs, they dropped down into contact with the strip below, throwing the current into the corresponding solenoids and drawing up the iron cores so that they struck the strings with a clear, sharp blow, dropping instantly as the paper was drawn forward, and the current shut off. The best average speed for the roll was found to be about two longitudinal feet per minute.

A Simple Vehicle Jack

By James H. Armstrong

ONE of the simplest forms of jacks for use in lifting the bodies of wagons or other vehicles is illustrated in the accompanying drawing. The device can readily be made by any amateur and the construction is inexpensive. The uprights of the jack consist of a single length of iron 1¼ by ½ inch, bent double or to hairpin form, with the lower ends secured in a block of wood measuring 2 by 6 inches. The ends of the uprights are fixed into recesses in the block, and are held in place by means of bolts as indicated by dotted lines in the drawing. The lever on which the vehicle



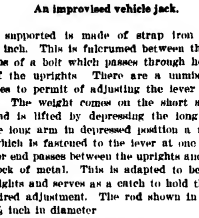
An improvised vehicle jack.

axle is supported is made of strap iron measuring 1 by 3/8 inch. This is fulcrumed between the uprights by means of a bolt which passes through holes in the sides of the uprights. There are a number of such bolt holes to permit of adjusting the lever to various heights. The weight comes on the short arm of the lever and is lifted by depressing the long arm. To hold the long arm in depressed position a rod is provided which is fastened to the lever at one end, while the other end passes between the uprights and is welded to a block of metal. This is adapted to bear against the uprights and serves as a catch to hold the lever at any desired adjustment. The rod shown in the drawing is 3/8 inch in diameter.

Lashing or Seizing Timbers Together

By Albert F. Bishop

TIMBERS from 7 to 10 inches in diameter can be bound together readily with wire about the size of that used in telegraph lines. The end of the wire is turned at right angles and fastened to the timber by a staple. The wire is then wound around the two pieces as tightly as possible from four to six turns. The end of the last turn is bent at right angles and fastened to the other timber by a staple. Now a small pointed bar is inserted in the center of the layers and



Method of lashing timbers together.

the layers are twisted several times as shown in the sketch. The writer believes two pieces could be bound together in this manner as tightly and firmly as the use of bolts could make them. This method requires very few tools and very slight expense for materials. This wrinkle can be applied to telegraph poles, flag staffs, or repairing fence posts, etc.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Healing Broken Machinery by the Electric Flame

By Joseph B. Baker

A BROKEN machine is only the picture of its real self. The machine is all there, but it is useless because of the break in some important part which destroys its strength. Now the unsound part may be healed and so reclaimed by the electric flame. The castings and forgings which make up large and expensive machines sometimes break in ordinary use, or are broken by accident, causing great loss, and delay to the work in which the machine is being used. The simple electric arc welding system, applied in an hour's work or more by a skilled man, makes such broken parts as good as new, no matter how "far gone" the crack, or how extensive the actual, open rupture through the very structure of the part.

For example, the motor shells and gear boxes of electric cars may become cracked by yielding to the fatigue of the metal in the ordinary operation of the car. Cracked motor shells were formerly either sent to the scrap-heap or else repaired by riveting a plate over the break. To send the part to the scrap-heap means practically throwing away an expensive steel casting on which perhaps, a lot of valuable machine work has also been done, and to repair the part by riveting is to fail to restore the original strength and rigidity. The same thing applies to the steel forgings of car-truck frames, parts of printing presses, or the part or forged parts of any good-sized machine. The need is, then, for some means of easily, quickly and inexpensively mending such broken parts.

This need is filled in the electric arc welding process, which can be used on the spot, wherever direct electric current is available, and in a small space ten feet square. Arc welding reclaims the part at an expense which is very small compared with the cost of a whole new part, a cost which does not exceed the expense of the far less effective riveting. The occurrence of a bad crack, or of an actual break in a big, expensive casting or forging is the opportunity of the arc welder to make whole and sound again a piece which had seemed irretrievably ruined. Steel castings cost more than iron castings, and it pays correspondingly better to repair them by the arc welding process. They are just as easily healed as the latter, and it is something worth while to recover a steel casting for example costing \$500 with half a day's work at an expense of a tithe (or less) of the first cost of the piece.

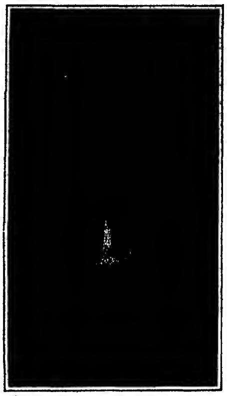
By the use of a direct current of 220 volts or over all castings and forgings except brass, bronze or copper can be repaired by genuinely welding the break, using the arc to soften the metal adjacent to the break and then feeding in a piece of metal of the same or better grade to fill in the break and make the piece integral. If alternating current only is available, it may be transformed into the necessary direct current by the customary apparatus for this purpose, such as the mercury arc rectifier for relatively small work. The process is simple and rapid, but certain precautions are necessary. The operator's only tool is the carbon electrode in its holder, a hand tool with means for protecting the operator's hand and body from the heat of the arc. The head and body are protected by a canvas hood, and the eyes by goggles having several thicknesses of colored glass. The carbon pencil, ½ inch to 1 inch in diameter, according to the size and shape of the work, is made the negative electrode, and the voltage is cut down to about 100 volts at the arc by a suitable adjustable resistance.

When the piece is once set and aligned, and the current turned on, the work proceeds with marvelous rapidity. The searching and penetrating heat of the arc easily softens metal shells of the ordinary thickness found in the structural castings of machinery or in the main or minor moving parts of the same, up to 4 inches; the ½-inch to ¾-inch thickness of a motor shell is quickly brought up to welding temperature necessary for a true union of the parts. If overheated by the intense play of the arc the metal runs like wax, and here is where skill and special manipulation of the powerful tool is required.

It is better of course to apply the welding process to pieces when they are first found to be cracked, or to have a crack starting, from some habitual or repeated stress or an accidental shock, and before they become broken away entirely: "a stitch in time saves nine." In some cases there is opportunity to make the work even better than new by welding upon it strengthening or reinforcing parts.

Mending a broken gear: a difficult job of arc welding. The gear teeth at the break were saved. The alignment had to be maintained exactly during the welding.

A mended break that extended from above the armature bearing to the gear-shaft bearing.



The arc welder at work on a railway motor shell. In practice the arc used is somewhat shorter than in the illustration.

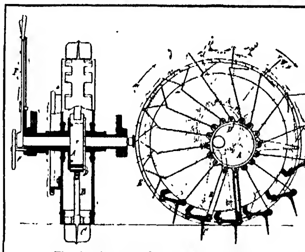


Fig. 1.—Front and side views of traction wheel with retractable blades.

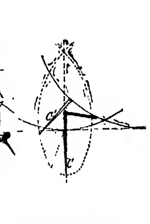


Fig. 2.—Paths of fixed and retractable blades.

The new traction wheel driving a plow through an alfalfa field.

Plowing a rice field; a supreme test for the traction wheel.

A Novel Italian Traction System

MOTOR-DRIVEN agricultural machines operate with difficulty over ground strewn with straw or other material of a slippery nature. In order to give the driving wheels an adequate purchase on the ground they must be made very heavy and must be provided with cleats. This adds a material load for the engines to drive and is entirely unnecessary in the opinion of two Italian inventors who have devised the traction wheel illustrated in the accompanying engraving. In place of cleats the traction wheel is provided with long blades, designed to dig into the ground. Whenever desired the operator may retract these blades, so that the machine can travel over an ordinary road without injury to the road. The construction of this wheel is illustrated to the best advantage in Fig. 1. The axle of the wheel carries an eccentric *A*, on which is mounted a strap connected by rods *B*, with the traction blades *C*. As the traction wheel revolves, the eccentric *A* remains stationary, but the strap *D* must revolve with the wheel and consequently the traction blade must assume the positions shown in the drawing. It will be observed that in the forward half of the wheel the blades project from the periphery of the main wheel rim *E*. The blades are pressed into the ground by the weight of the wheel, but are immediately retracted after passing the point of contact of the wheel with the ground. As the blades are retracted in a vertical direction they do not serve to scoop holes in the ground as would fixed cleats of the same depth. Fig. 2 shows in full line the cut in the ground made by the blade that is retractable, while the dotted lines show the large hole in the ground that would be scooped out by fixed blades projecting from the rim of the traction wheel.

When it is desired to run the traction wheel without projecting the blades into the ground, they may be moved to a different position by operating the lever *F*, so as to throw the eccentric *A* to the position shown by dotted lines in Fig. 1. Then the blades will project from the upper half of the wheel and will be withdrawn in the lower half where the wheel comes in contact with the ground. One of the accompanying illustrations is a photograph of the machine operating through a rice field. Here it is put to an extreme test for the reason that the field is flooded with water, and affords very little purchase for a traction wheel. Another picture shows a plow equipped with a traction wheel of the new type, operating in an alfalfa field. The new type of traction wheel affords an ideal hold on the ground and permits of reducing materially the weight of agricultural machinery. Furthermore, the ability to regu-

the depth to which the blades will sink into the ground and to retract them completely if desired, is a very important advantage.

The Trade-mark as a Business Asset

By W. E. Woodward

THE average business man has only the vaguest notion of the value of a trade-mark. He does not realize that it is very often the connecting link between the producer and the ultimate consumer; that it is a symbol of good will, a tangible asset with a determinable money value; that it must be chosen and applied not in a haphazard way but with a due regard for its psychological effect upon the public. Nor does he realize the importance of complying with the statutory requirements which secure to him a property right in a trade-mark comparable with the property right that an inventor acquires by taking out a patent.

The following is the last of a series of articles, written by a man who is at once a trade-mark, an advertising, and a business expert, a man who has a first hand knowledge of the value of trade-marks and of the correct methods of trade-mark exploitation. The series, which will be eventually published in book form, included discussions, written in business English, of the Federal trade-mark law, analyses of the requirements for registration, the elements of a good trade-mark, and trade-mark promotion.—EDITOR.]

An Ingenious Similarity of a Trade-mark.

—IX.

(*Concluded from page 184, August 31st, 1912.*)

An infringing mark may be so nearly like a well-known and valuable trade-mark that the unwary or careless may be deceived, yet, at the same time, it may be so dissimilar that a show of defense may be made. The National Biscuit Company has prosecuted more than five hundred infringements of its trade-marks. "Uneeda" Biscuit has been imitated by "Ulika," "Uwanta," "Iwanta" and dozens of other specious wordings.

The mark "Yusea" used on incandescent gas mantles, was infringed by "U-C-A." In this case there was no similarity whatever in the appearance of the marks, but evidence was produced to show that "Yusea" was pronounced "You see a," and that in sound the marks were precisely the same. Priority of registration of the "Yusea" mark was proved and the use of "U-C-A" was accordingly enjoined.

The word "Chasseuse" was held by the court to be an infringement of "Chartreuse"—both marks being applied to cordials.

"Grape Nuts," a cereal food, was not infringed by "Grain Hearts." "Old Crow," the name of a whiskey, was not infringed by "Old Jay."

On the other hand "Colonial Dame" used in connection with perfumery, was infringed by "Colonial."

"Chatter-Box," an annual publication for children, was infringed by "Chatter-Book," used as the name of a publication of the same general appearance and purpose.

The Right to Use One's Name and Its Limitations.

A typical case of this kind is that of Royal Baking Powder Company v. Royal (122 Fed., 337-1903; 58 C. C. A., 499-500). An individual by the name of Royal went into the business of manufacturing baking powder. His product was sold in packages of the same general appearance as those containing the product of the Royal Baking Powder Company. The court held that the respondent could use his own name, but "in the least conspicuous manner possible consistent with the right to place his name and address upon the goods made by him."

A similar case is that of Von Faber v. Faber (124 Fed. R., 603). In this case the plantiff, a manufacturer of lead pencils, was the owner of a business founded in 1761. The pencils made by this firm had always been marked "A. W. Faber." The defendant, also named Faber, began to manufacture pencils in the United States, affixing to his product the mark "Faber." The court held that this was an unfair use of his name, and while he had a right to use his own name, yet he must prefix to it "John E," "Eberhard" or "John Eberhard."

The well-known chocolate manufacturers of Dorchester, Mass., Walter Baker & Co., have had to contend with many individuals bearing the name of Baker. In each case the decisions of the court have been to the effect that any Baker has a right to manufacture and sell chocolate, and to use his own name on packages of his product, but his name must be accompanied by some statement or distinguishing mark which will clearly differentiate his product from that of Walter Baker & Co.

In the case of Williams v. Mitchell (106 Fed. R., 168-171) the court said: "One may not use his own name for such purpose when it works a fraud. If he uses a descriptive word, or a geographical name, or his own name, it must be so used as not to deprive others of their rights or to deceive the public, and the name must be accompanied with such indications that the thing manufactured is the work of the one making it as would unmistakably inform the public of the fact."

Casual Resemblance Is No Infringement.

A manufacturer of a lantern known as a "Hurricane" lantern claimed that the name of another lantern, called "Tempest," was an infringement. The court held that while there was a resemblance in the names in the underlying idea, they were so different in appearance and sound that any person of average common sense would not mistake one for the other.

"S. B.," a trade-mark for cough drops, was not infringed by "B. and S."

"Weber," a mark for pianos, was not infringed by "Webster." In this case there is a casual resemblance in appearance in the two words, but no resemblance or very little, in sound.

The Plaintiff Must Come Into Court With Clean Hands.

The courts will not use their power to perpetrate a fraud. A trade-mark conveying a misrepresentation of the composition, character or quality of the goods with which it is used, cannot be protected against infringement.

How Legislators View Patents

THE debate on August 7th in the House of Representatives upon the question of appropriating ten thousand dollars to investigate the Patent Office, developed some interesting statements from different Congressmen. Chairman Oldfield of the Patent Committee said, "the Patent Office has taken in and turned into the Treasury about $7,000,000 more than it has taken out of the Treasury." In speaking of the great corporations, who are said to take men out of the Patent Office, the same gentleman said: "They want men who have started at the bottom in the Patent Office and have worked themselves up to the Commissionership or assistant Commissionership." If they want such a man, we do not recall an instance in which they got one, as ordinarily the force of such companies is recruited from the assistant examiners of the Patent Office.

Congressman Mann said, he thought the salaries in the Patent Office ought to be increased, but asked if Chairman Oldfield did not believe the Government would never be able to compete with salaries offered by outside people. Congressman Bowman remarked: "I have had some business with the Patent Office and the work that they have done for me, has always been efficient." Mr. Bowman also said: "Ease in securing a patent is, I believe, of great advantage to the country," and further "I consider as one of the greatest assets of this country the inventive genius of its people. I do not favor the suggestion of the committee, that there might be a slight advance in Patent Office fees. They should be kept low and every encouragement and assistance given inventors."

Referring to the bill to codify the patent statutes upon which hearings have been had this year, Chairman Oldfield said, "a substitute for that bill will be reported to the House in a few days, but it is not believed that it will be possible to discuss the bill or pass the bill at this session." This appears to settle the question as to any revision of the patent laws at this session of Congress.

In the course of the debate, Chairman Oldfield referring to the compulsory license of the proposed new law, pointed out that it differed from other laws of the kind in that it did not apply to the original inventor, but only to those corporations or persons who acquire patents for the purpose or with the result of stifling competition.

Speaking of the bill about to be introduced, Congressman Lafferty said, as he understood the bill, it would make it a penal offence for the owner of one patent to buy another patent with the intention of restricting or interfering with its manufacture or sale, and Chairman Oldfield replied that such was the intended result.

With reference to the Sherman anti-trust law, Mr. Oldfield announced that a great many of the best patent lawyers in the country to-day, take the position that the law does not apply to patent monopolies, but that the proposed bill will provide that the law shall be applicable to those monopolies created by the accumulation of patents.

Included in the debate was a brief discussion as to the constitutionality of deputizing to a court the fixing of a license fee, Congressman Cooper asking whether such fixing was a judicial function and suggesting that a court cannot fix the rate, but it can decide whether the rate is confiscatory or not. At any rate, Chairman Oldfield said the bill is not to be pressed for passage at this session of Congress.

Notes for Inventors

Four Glass Drawing Patents.—Four patents, numbered from 1,034,445 to 1,034,448, inclusive, have been issued for the inventions of Mark J. Healy of Bradford, Pa. The inventions relate particularly to devices in connection with glass drawing apparatus and to the ring shields and fenders operating in the tanks of such apparatus.

Wanted: An Artificial Bait.—John W. Hurley, is well known among Washington city fishermen, for his skill with the rod and reel. A recent issue of the Washington *Star* says, that Mr. Hurley thinks it about time that some one invented an artificial bait for salt water fish and quotes the veteran angler as saying:

"Peelers make fine bait, and soft crabs are not bad, but usually it is hard to get them at places, where there is a chance to make a good catch. Some of the fishermen laughed at me, when they saw me taking soft crabs from the city for bait, but when they reached the fishing grounds, they were sorry they hadn't invested in some of them in the city."

A Moth-proof Fly Book.—A patent has been granted to F. J. Cooper of San Francisco, Cal., for a fly book which should be of interest to fishermen. The inventor, when he first started out in his career as a fisherman, bought everything that was recommended as needful. A generous assortment of expensive flies formed part of his equipment. He found that the flies lasted just one season. When springtime came he went to his kit and was amazed to find that the moths had cleaned his books of dozens of flies. That inspired the idea of a moth-proof fly book. The result is a book that is moth-proof, in which there is no metal in contact with the hooks, which is dust-proof and damp-proof. A celluloid window on the top of each of the envelopes constituting the leaves, permits the user to see at a glance just what fly he wants. The book is made on the loose-leaf principle and holds twelve to fifty-four dozen flies.

An Electrically Conductive Ink.—Two patents, Nos. 1,034,103 and 1,034,104, have been granted for the inventions of Hyman Eli Goldberg, wherein he provides a visible writing ink having as one of its constituents a good electric conductor so that the ink when applied to the paper by an ordinary writing pen and dried can be used to conduct electricity along the characters thus produced upon the paper.

The Patent Medicine Situation in England.—A committee of the House of Commons has, for some time past, been holding sessions in London for the purpose of investigating the law regarding the sale and advertisement of patent medicines in the United Kingdom.

In the course of the investigation, it has been developed that the sale of such medicines is equivalent to one package per year for every man, woman and child in the country, that as estimated by one witness, the amount of money spent on proprietary medicines in Great Britain alone in one year amounted to $12,166,250 or sufficient to maintain 40,000 hospital or sanatorium beds and that notwithstanding the enormous amounts expended, the solicitor to the customs and excise department stated, in answer to question from the chairman of the committee that there was nothing, in his opinion, in the law as it now stood to prevent any person making up any sort of mixture containing anything except obvious poison, from advertising it as a cure for any disease, and selling it to the public on payment of the stamp duty. He added that probably the police could prosecute if absolute fraud were established, but that it would be exceedingly difficult, in his judgment, to obtain evidence that would insure a successful prosecution.

Legal Notes

Patentability Not Involved in Interference.—The Court of Appeals of the District of Columbia in the interference case of Putnam v Wetmore and Niemann, has held that the question of the patentability of the issue of an interference, will not be considered by the Court of Appeals and says, quoting a number of other cases "In interference cases we do not determine whether either party shall receive a patent. The question presented to us is, conceding there is a patentable invention, which party was the first to invent or discover the same."

Reasonable Doubt as to Similarity.—The Commissioner of Patents, in the case of J. & Riley Carr v. The William Schollhorn Company v. Warren Ax & Tool Company v. Geo. H. Bishop & Co v. Radigan, Rich & Co. v. Draff v E. C. Atkins & Company, has held in a trade-mark case that where there is a reasonable doubt whether there is deceptive similarity between the mark of an applicant and that of a prior registrant, and the consent of the registrant to the registration by the applicant of his mark is secured, that the doubt should be waived in favor of the applicant and his mark registered.

A Decision Affecting Absinth.—The Board of Food and Drug Inspection of the Agricultural Department has issued a decision, No. 147, under the section of the Food and Drugs Act which forbids the importation of any food or drug which is "of a kind forbidden entry into, or forbidden to be sold or restricted in sale in the country in which it is made, or from which it is exported," and also of any food or drug which is "otherwise dangerous to the health of the people of the United States," calling to attention that importations of absinth into the United States, are prohibited, both because they come from countries which forbid or restrict its manufacture and sale, and because these products are injurious to the health of the people of the United States. The decision holds that the Secretary of Agriculture will regard as adulterated under the Food and Drugs Act absinth which, on and after October 1st, 1912, is manufactured or offered for sale in the District of Columbia or the Territories, or shipped in interstate commerce or offered for importation into the United States. The effect of this decision upon trade-mark registration is somewhat problematical, especially as to the marks, should there be any, applied to absinth manufactured in this country and designed for export.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

BELT BUCKLE.—L. SANDERS, 621 Broadway, New York, N Y A highly important result obtained in this construction is the rigidity between all the parts of the base of the buckle, the arrangement being such that rigid relation is maintained between the means for fastening the buckle to the belt and means for adjustably making connection between the free end of the belt and the front end of the buckle

DRESS.—D ZAVODNIK, 40 Walker St, New York N Y This invention relates particularly to a lady's house dress, and an object is to provide a dress which will be neat in appearance about the waist, avoiding the objection raised to the loose fitting morning dresses, and which will adhere to the waist of the wearer, irrespective as to whether or not corsets are worn

Pertaining to Aviation.

FLYING MACHINE.—T W CAREY, JR, 809 Canal St, New Orléans, La. It is the object of this improvement to provide a flying machine with one or more sets of equilibrium planes and ailerons adapted to counteract the tilting action and to reduce the inverse angle, whereby shorter turns may be accomplished with less danger.

FLYING MACHINE.—C A. HAMILTON, Box 421 Sag Harbor, N Y An object here is to provide a machine of the helicopter type with a plurality of propellers, and means for directing the line of action of said propellers so as to traverse the machine in any direction; also a machine with a plurality of helicopter propellers, with means for throwing into and out of operation any one of the propellers

Of Interest to Farmers.

CRANK HEAD FOR MOWING MACHINES.—L. R. WHITESIDE, R F D No 6, Belleville, Ill. A purpose here is to provide a crank head with a crank pin sleeve having a plurality of pairs of trunnions interchangeable with the pitman, so as to take up the wear and obviate irregularities in the movement of the mechanism, so as to prevent excessive jarring.

Of General Interest.

GASOLENE FILTER.—J. C KLATZL, 45 W 83d St, New York, N Y This invention pertains to a new form of gasolene filter, and an object is the provision of a device of the above indicated character from which the water or other heavy substance will be baffled and precipitated from the gasolene before the latter passes through the screens common to devices of this character From this device the screens may be readily removed and inserted A further object is to provide a device which may be readily cleaned and in which the several parts may be quickly assembled or removed The engraving pictures a vertical sectional view of the filter.


GASOLENE FILTER

FILTER.—E SEAVEY, Manhattan, N Y, N Y This invention relates to a filter for filtering any desired liquid material, such as sugar solution, water or petroleum Means are provided by the invention whereby the sediment and foreign particles filtered out from the liquid can be collected in a catch basin and at suitable intervals removed from the filter

BRACKET FOR CARD HOLDERS.—J A MANSON, 347 W 87th St, Manhattan N Y., N Y In the present patent the improvement has reference to a bracket for pivotally mounting holders for display cards and an object of the invention is to provide a simple inexpensive holder for card plates so that the latter may be readily and quickly dismounted from the bracket.

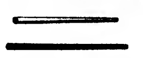
Hardware and Tools.

RIVET CALKING TOOL.—J WOODWARD, Box 206, Leetonia, Ohio The aim of this inventor is to provide a new rivet calking tool, which is simple in construction and arranged to permit a ready change in the calking hammers and guide for the use of the tool on different forms of rivet or bolt heads, with a view to calk or tighten the rivet or bolt

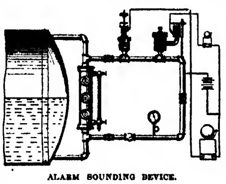
APPARATUS FOR SPLICING ROPES AND CABLES.—H. H. WILSON and H. H. ROSS, Box 877 Nasel, Wash The object of this improvement is to provide a conveniently portable apparatus, by means of which the ends of ropes and cables may be securely held while being spliced, and also to provide means whereby sufficient pull may be exerted on the spliced strands to draw them into position in the splice

Heating and Lighting.

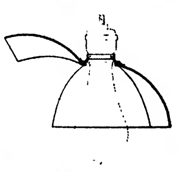
MATCH.—G. W. CURTISS, Blackwell, Wis. This match is a substitute for the wooden one and usable in the same manner by striking against any friction surface. A solid metallic body is provided having at its forward end a pocket extending axially a short distance, producing a tubular formation at the striking end. In this pocket is packed an absorbent such as absorbent cotton saturated with kerosene or other inflammable fluid. Over the end of the filled pocket and the end of the tubular shell thereof is affixed a striking head to cover the absorbent and shell in a way that the composition constituting the tip firmly adheres to the absorbent and to the shell, more particularly the former, by filling the interstices of the filling at the forward end of the pocket. The upper sketch is a perspective view and the lower a longitudinal section


METALLIC MATCH.

ALARM SOUNDING DEVICE.—R. A. GASCH, R. F. D. No 1, Box 168, Seattle, Wash. The object of this inventor is to provide a device which will in all cases sound an alarm when the pressure communicating therewith falls below or rises above predetermined points, the device being so constructed that the alarm may be sounded at any points desired relatively to the device. Another object is to provide in connection with the said device means to afford communication with the atmosphere to reduce the pressure when the pressure reaches a point where the alarm is sounded The illustration shows a side sectional elevation of the invention, showing how it is connected with the boiler.

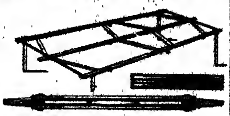

ALARM SOUNDING DEVICE.

LAMP SHADE.—N B. MCGHEE, Clifton Apts, 231 N Broadway, Los Angeles, Cal The object of this invention is to provide a shade for lights or lamps, more particularly for incandescent electric light bulbs, so constructed and arranged that it may substantially or entirely conceal the light, or be adjusted to reflect the light downward, or while shading the greater portion of light, enable the light to be projected and reflected in a particular direction. The device may be used for warming hands; or in the sick room, placed in bed for warming feet and other parts of the body. Hospitals will find this shade of value in doing away with paper pinned around lamp bulbs The engraving illustrates one of the wings raised to reflect light in a particular direction.


LAMP SHADE.

Household Utilities.

CURTAIN STRETCHER.—H. MORLEY, 15 Edwards St Patchogue, N. Y. This stretcher is arranged to fold with a view to provide a comparatively small bundle for conveniently storing the stretcher when not in use and to allow quick and accurate adjustment to accommodate curtains of different sizes. For this, use is made of side rails, adjusting bars intermediate the said side rails, pairs of links connecting the adjusting bars with said side rails, slides slidable on the adjusting bars, and end spacing bars pivotally connected with the said slides and adjustably connected with the side rails to hold the latter spaced the desired distance apart. The engraving shows a perspective view of the stretcher extended ready for use; a plan view of the stretcher folded; and a side elevation with the parts in folded position.


CURTAIN STRETCHER.

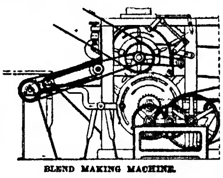
COVER FOR IRONING BOARDS.—T. M. BROOKMAN, 762 Spaulding St., Elmira, N. Y The intention here is to provide a cover for an ironing board arranged to permit plain ironing, ironing of filagree or lace, and to allow of readily placing the cover in position on the board or removing it therefrom.

Machines and Mechanical Devices.

ADDING COUNTER.—W. F. MULLANEY, Box 685, Marshall, Minn. This device will accurately measure the travel of a reciprocating element. In counters now in common use, it is not possible to accurately measure the travel of a reciprocating body, such as a piston rod of a pump, due to the fact that the counter does not register until the entire stroke has been made.

AIR WASHER.—M. S. KING, care of Wells & Newton, Ave B, 17th and 18th Sts., New York, N. Y. The object here is to provide an air washer which will thoroughly cleanse and humidify the air used in heating and ventilating plants, the washer being constructed with a hollow shaft, supported at one end by the shaft in the blower, which is freely disposed in the hollow shaft, which is disposed in and is keyed to the hollow shaft.

BLEND MAKING MACHINE FOR STAPLE GOODS.—A. I. GERRY, Sanford, Maine. By this mechanism mixing and blending are done with a minimum of hand work, the material being thoroughly intermingled and cleaned during operation, the action being such that the material is fed into the machine in charges of predetermined size, these charges being admitted at intervals when various movable parts are in position for the charges to be taken in. Mixing and blending can be better done if the material is first operated upon in the mixing chamber and thence transferred to another mixing chamber and there operated upon under somewhat different conditions The view shown is a fragmentary side elevation, and shows the first mixing chamber and parts associated therewith

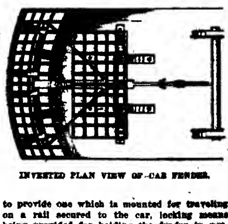

BLEND MAKING MACHINE.

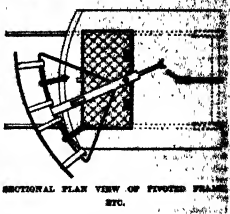
Pertaining to Recreation.

TOY AEROPLANE.—A. S. HECHT, 64 W. 88th St., Manhattan, N. Y., N. Y. This invention relates to toy aeroplanes, and the aim is to provide one which may be constructed at trifling expense, so that the aeroplanes manufactured in quantities, and may be given away for advertising purposes or to be sold for a few cents.

Railways and Their Accessories.

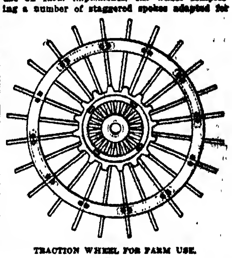
CAR FENDER.—C. B. MARTIN, Room 18, Cambridge Bldg., Portland, Ore. This invention relates to car fenders, and the object is to provide one which is mounted for traveling on a rail secured to the car, locking means being provided for holding the fender in normal position until it is pressed rearwardly, when the [illegible] fender is moved to the [illegible] in contact with the [illegible] pressed it rearwardly. [illegible] to assist in moving the fender [illegible] provides a pivoted frame [illegible] disposed in a horizontal position, [illegible] is permitted to drop when the fender is moved to either side. The first illustration shows an inverted plan view of the fender mounted on a car; and the second is a sectional plan view showing the pivoted frame, the apron disposed thereunder, the mat, and the means by which the last is connected with the pivoted frame.


INVERTED PLAN VIEW OF CAR FENDER.


SECTIONAL PLAN VIEW OF PIVOTED FRAME, ETC.

Of Interest to Farmers.

WHEEL.—J. E. MCWILLIAMS, Hitchcock, Okla. This invention relates generally to wheels, and more particularly comprehends a traction wheel, especially intended for use on farm implements, for field work in especially plowed ground. The principal object is to provide a traction wheel especially adapted for use on farm implements, the wheel comprising a number of staggered spokes adapted for engagement with the ground whereby the implement may be drawn thereover. This invention overcomes the disadvantages following the use of a rim wheel; the wheel involves a number of radiating and staggering spokes adapted for engagement with the ground, thereby avoiding the packing of the ground after being furrowed by implements having flat rim wheels. The engraving shows a side view of the wheel.


TRACTION WHEEL FOR FARM USE.

Designs.

DESIGN FOR A LAMP CLUSTER.—J. D. ROSS, Seattle, Wash. This ornamental design for a lamp cluster when mounted upon a pole, standard or other support, presents an elegant cluster of five globes in a line, the upper three of which rest on a base, while the two remaining and outer ones hang from the ends of the form constituting the fixture. The three upper globes are somewhat larger than the lower ones.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

[illegible] on separate sheets [illegible] upon each mat[illegible] This [illegible] your ques[illegible] to be re[illegible] name and address [illegible]. No attention [illegible] queries. Full hints [illegible]nted from time to time [illegible]quest.

[illegible]asks: Can you kindly [illegible] what is the best heat insu[illegible]ly obtained for the insula[illegible]? A. No complete insula[illegible]. Wool is the best which [illegible]. Asbestos is good. Such [illegible]heat because they prevent [illegible] and thus convection cur[illegible]ansferring the heat from [illegible]urface. This is the phil[illegible] thermos bottle, in which a [illegible]en the glass bottle inside [illegible]outside.

[illegible]asks: Can a man exert [illegible] pull than his own weight, [illegible]osition that he may take? A. [illegible] steady downward pull on [illegible]rection, a man cannot pull [illegible]eight. He will then leave [illegible] himself into the air. He [illegible]reater downward force on a [illegible]eight by giving a jerk. By [illegible]d inertia he greatly increases [illegible]rope.

(12677) [illegible]M. A. asks: 1. Are there any theor[illegible]ed in regard to size and shape of an [illegible]ining an individual element, [illegible]each element, with a probability [illegible]ing a simple substance of matter? A. We [illegible] anyone holds that the size and shape of [illegible] determines the kind of matter [illegible] held by many that the difference [illegible] lies in the number of electrons [illegible]tain. The hydrogen atom, which is the [illegible], contains about 800 electrons. [illegible] hold this view will conclude that all [illegible]nts are derived from one form of mat[illegible] they would say that the parent of [illegible] that primal form. 2. Does not the [illegible] or atomic arrangement have the larger [illegible] the making up of an organic compound? A. [illegible] seems to be no reason for saying that the [illegible]arrangement is any more important in [illegible] substances than in inorganic substances. You will find two books of especial interest in this [illegible]: Duncan's "New Knowledge," price $2, and [illegible] J. Thomson's "Electricity and Matter," [illegible]1.25. From these books you will get the [illegible] view.

([illegible]2678) J. A. S. asks: As I have [illegible]ht almost everything I have read about on [illegible]construction of induction coils, have not yet [illegible] what is most essential; in fact, everything I have seen or read does not give enough information for the average amateur, leaving too much for the experimenter's imagination. I now have purchased 18 pounds of No. 36 wire and wound two coils carefully, one with cotton, the other with silk insulation. The cotton-wound coil has 46 double sections and the silk coil has 56 double sections, neither one giving more than a 6-inch spark. I do not know why, and cannot get the information anywhere. Possibly you could help me. Can you give me the address of some one or firm that I would be likely to get the information wanted? A. You have taken the very best course for finding the best method of making an induction coil, in buying Collins' book, which tells the whole story, from beginning to end, leaving nothing to the imagination. We cannot refer you to any better source of information. No firm making coils will give you advice. An induction coil is the result of an evolution by experiment. The man who has produced a form which gives good results will not publish the points in which his success lies. The book by Collins is the first effort to cover the subject of design for all sizes up to a coil giving a 12-inch spark. We think it quite reliable. Of course, there are many variations from his design, which might give good results. It is an old rule that you ought to get an inch of spark for each pound of secondary wire. Your coils are not up to this.

(12679) W. C. B. asks: As a disinfectant (inexpensive) for garbage can is air-slaked lime effective? Does it become inert when exposed to the air? Is charcoal a deodorant? What is your opinion of this formula: 3 pounds iron sulphate, 3 pounds slaked lime, 4 pounds road dust? A. Chloride of lime is a much better disinfectant than air-slaked lime for a garbage can or other domestic use. Charcoal acts as a disinfectant by absorption. It takes gases into its pores and thus removes odors from the air. If the charcoal is then burned the bad gases with their odors are destroyed. In the formula which you send iron sulphate is the active material and is one of the best disinfectants. The road dust serves simply as a vehicle to carry the iron sulphate. The slaked lime has some value but not so great value as many other [illegible]. For many formulas of high value for disinfectants we would refer you to our Cyclopedia of Receipts, price $5.

NEW BOOKS, ETC.

The Sun. By Charles G. Abbot. New York and London: Appleton & Co., 1911. 12mo.; pp. xxv, 448. Price, $2.50.

This is a book that was needed, and it has been written by the right man.

Hitherto the standard work in English on this subject has been Prof. Young's "The Sun," the latest revision of which appeared sixteen years ago, and is now out of print. Since it was published, at a time when solar physics was just beginning to be recognized as a field of research worthy of the whole time and attention of a numerous body of workers, this branch of science has made great progress, the record of which is scattered through a long file of the *Astrophysical Journal* and other kindred periodicals. Building upon Young's admirable treatise as a foundation, Mr. Abbot has given us a most welcome digest of all that is known to-day concerning the sun. As to the competence of the author, probably few of our readers will need to be told that he was Langley's assistant at the Smithsonian Astrophysical Observatory, and now, as director of that institution, is the world's foremost investigator of the problems of solar radiation.

The book is quasi-popular, i. e., it avoids the intricacies of mathematical physics on the one hand, but on the other can hardly be read to the fullest advantage by our friend in the street. The following are the chapter heads: I. The Solar System. The Sun's Distance. Its Dimensions. II The Instruments and Methods Used in Solar Investigation. III. The Photosphere. IV. Eclipses and the Outer Solar Envelopes. V. Sun-spots, *Faculæ and Granulations.* VI. What is the Sun? VII. The Sun as the Earth's Source of Heat VIII. The Sun's Influence on Plant Life. IX Utilizing Solar Energy. X. The Sun Among the Stars.

Comparing Abbot's book with the earlier literature on the subject available to persons who read only English (Pringsheim's "Physik der Sonne" has, of course, brought the matter fairly up to date in German) we find that a great deal of information formerly given in a vague and tentative way, is now stated as *res judicata*. The spectro-heliograph, for instance, has cleared up a great many problems The solar constant—which is fundamental in meteorology and geophysics, and the exact determination of which has been an urgent desideratum of these sciences—is at last definitely stated to average 1 95 calories (it is subject to some fluctuations) and Abbot's own work makes this value completely trustworthy All other existing reference books and text-books in English give either a considerably higher value, or present the values obtained by numerous investigators, ranging from 1 76 to 4 06, leaving the student very much at sea as to the most probable one.

Recent advances in the measurement of solar radiation have, of course, been conditioned by the improvement of pyrheliometric apparatus, and there is probably still some work to be done in this direction. The author gives us a description of the Angström instrument—which was somewhat rashly adopted a few years ago for official international use—and of course fully describes the more satisfactory types of instrument for which he himself is responsible; but does not refer to the Marvin pyrheliometer, now in use by the Weather Bureau—possibly because Prof Marvin himself has not yet published an account of this as yet unperfected instrument. Since Mr. Abbot's book was written Prof. Humphreys, also of the Weather Bureau, has announced that he is at work at still another instrument of this class

The chapter on "The Sun's Influence on Plant Life" discusses an important subject which was not touched upon in Young's book, and concerning which there is a dearth of popular literature. From the interesting account of solar engines, solar heaters, and kindred devices we learn that "excepting the solar heaters for bath purposes commonly installed in the roofs of houses, it does not appear that appliances for utilizing solar heat are yet introduced with economical success." Nevertheless, the author is quite hopeful on this subject.

The book abounds in minor typographical errors. Good proofreaders appear to be scarce nowadays in American printing offices. We fear the author himself must be held responsible for misspelling Leverrier's name four times on one page.

Reinforced Concrete Construction. In Theory and Practice. An Elementary Manual for Students and Others. By Henry Adams and Ernest R. Matthews. New York: Longmans & Co., 1911. 8vo.; 316 pp.; illustrated. Price, $3.

A short history of reinforced concrete paves the way for an intelligent study of theory and practice. The theory is confined to such principles as have a direct bearing upon actual conditions and requirements, and the mathematics of the work are kept within the strictest possible bounds of simplicity. Among the special constructions discussed may be mentioned retaining walls, bins and bunkers, chimneys, reservoirs and tanks, culverts and conduits, swimming baths, public shelters, underground lavatories, railway bridge work, wharves, jetties, and sea walls, and factories. Both American and English examples are usually cited and the numerous cuts are classified and grouped under the various branches of construction, so that each branch graphically presents a variety of typical forms. The work is on the whole admirably adapted to aid the beginner to a knowledge of real conditions, requirements and methods.

Concrete Costs. Tables and Recommendations for Estimating the Time and Cost of Labor Operations in Concrete Construction and for Introducing Economical Methods of Management. By Frederick W. Taylor, M.E., Sc.D., and Sanford E. Thompson, S.B. New York: John Wiley & Sons, 1912. 8vo.; 709 pp.; illustrated. Price, $5.

In estimating costs, the method advised is that of dividing each kind of work into a series of elementary operations, of timing and recording each of the "unit times," and finally of adding together the results in order to obtain the cost of the job. Tables are given showing just how long a workman should take to do a particular task—tables which have been obtained only after most exhaustive tests with the stop-watch on actual work Each piece of work in a trade has been reduced to its minor details; the efficient movements of the workman have been isolated from the inefficient and unnecessary; and each elementary movement has been studied with the stop-watch in hand The series of movements have then been grouped, the unit times summed up, and a sufficient margin allowed for unavoidable delay and accident Finally, the classification and tabulation of the data has been so carried out as to make practical reference to them a simple and sure matter The architect, engineer, contractor, superintendent and foreman will all appreciate the help here extended.

The British Journal Photographic Almanac and Photographer's Daily Companion. 1912. New York: George Murphy, Inc. 8vo.; 1,436 pp.; illustrated. Price, paper, 50 cents; cloth, $1.

This guide, philosopher, and friend of the photographer comes to us this year as multicolored and as corpulent as ever The enormous sections devoted to advertisements are bewilderingly kaleidoscopic .They contain some good pictures whose merits are credited to various lenses The almanac proper calls particular attention to the dates connected with the history of photography —the births and deaths of its great men, its discoveries, inventions, and processes. The reference section has too much matter for a satisfactory summary here, but includes among other things of interest to American readers an epitome of progress for the past year, hints on the management of studios, recent novelties in apparatus, the developing formulas of the principal plate and paper manufacturers, and some useful tables

Penrose's Pictorial Annual. The Process Year Book. Edited by William Gamble. Vol. 17, 1911-1912. New York. Tennant & Ward. 4to.; 305 pp Price, $2.50.

Those who have seen former volumes will take up this current issue with a pleasurable thrill of anticipation, and there is little chance of their feeling any disappointment. What very little indifferent work is exhibited is so buried in a mass of highly meritorious reproductions that it would be hypercritical in us to resurrect it A reproduction of the Mona Lisa forms the frontispiece of the volume, and thenceforward mellow collogravures, rich autochromes, restful monotints, and bright kinemacolors elbow one another for space between the covers. The wealth of pictures should not lead us to neglect the text, however There are many papers full of suggestion, information and help "Photography and Aeroplanes," "On Making Line Drawings from Photographs," "A New Style of Retouching in Machinery Illustrations," "Thoughts of an American Printer," "My Impressions of Kinemacolor"—these few subject-headings will show the diversity and scope of the discussions. No one who professes to keep in touch with illustration and process work can afford to ignore this yearly review, and it is worthy of a place on the table of the general reader and picture-lover merely by virtue of its splendid reproductions and its pleasure-bestowing power

The Locomotive. Vol. XXVIII. Hartford, Conn.: The Hartford Steam Boiler Inspection and Insurance Company, 1910-1911. Price, $1.

This bound volume of the little paper called *The Locomotive* contains all the issues of 1910 and 1911, and gives, among other things, a list of boiler explosions for each month, summaries of inspectors' reports, and articles and illustrations dealing with noteworthy explosions and the lessons they convey. An index is included which gives easy access to the miscellaneous information of the volume.

The Mechanics of the Aeroplane. A Study of the Principles of Flight. By Captain Duchêne. Translated from the French by John H. Ledeboer, B.A., and T. O'B. Hubbard. New York: Longmans & Co. 8vo.; 231 pp. Price, $2.25 net.

The name Duchêne will be familiar to those who have followed recent progress in aeronautics as that of an original and careful investigator of the laws and principles of dynamic flight While making no claim to having attained to more than approximate formulae, Capt. Duchêne has made accessible to the general reader and to the student a large body of knowledge concerning the behavior of aeroplanes under varying conditions. The mathematics used are purposely elementary, and all explanations and expositions assume only superficial knowledge on the part of the reader. The clearest possible wording is aimed at, and very generally attained. The four main divisions of the work deal with flight in still air, with the equilibrium and stability of the aeroplane in still air, with the effect of wind on the aeroplane, and with the problems of propulsion Among other useful tables are those for rapidly calculating the power required to fly an aeroplane, and for quickly finding the gliding slope. There is a summary of the chief properties of horizontal flight which will be most helpful to the student, and the chapter on the screw propeller is not the least important of the work. As a textbook, it will give the student a fair grounding in principle, and may save experimenters from many discouraging mistakes due to a failure to recognize or to properly take into consideration some necessary factor of a problem.

The Kingdom of Dust. By J. Gordon Ogden, Ph.D. Chicago: Popular Mechanics Company, 1912. 16mo.; 116 pp.; illustrated. Price, 50 cents.

One of the most fascinating things to children the world over is that of observing the Kingdom of Dust as revealed by the sunbeam In a somewhat speculative but none the less charming manner the author gives us the individual character of the inhabitants of this kingdom—the particles of musk, bits of iron and steel, scraps of leather, fragments of wood, cotton, silk, stone, gold, tin, wool, hair, paper, clay—in short, particles of every ingredient earth knows. His revelations will prove most absorbing to the young, and, aside from conveying instruction of real worth, must kindle in them a desire to pursue such studies further.

The Basic Open-hearth Steel Process. By Carl Dichman. Translated and edited by Alleyne Reynolds New York: D. Van Nostrand Company, 1911 8vo.; 334 pp.; illustrated. Price, $3.50 net.

The manufacture of steel by the basic process presents many problems which have thus far failed to bring forth adequate solutions The painstaking investigation of these problems by Carl Dichman is the basis of the volume in hand. He has first endeavored to establish conditions admitting of the complete utilization of raw materials in the best way This has entailed a vast amount of labor in quantitatively estimating the effect of all determining factors A lack of knowledge as to the conditions necessary to the economical utilization of fuel led him to devote his initial energies to the theory of gas producer working. The translator recognized in Mr Dichman's research a most valuable contribution to the science of its subject. The calculations are presented in minute detail, in order that independent investigators may check from step to step as they lead on and up to the eventual formulæ It is hoped that other investigators will use the data in this way, so that the fact or falsity of the author's premises and conclusions may be definitely determined, and the open questions which now vex the subject may receive something approximating to final and unanimous answers

How to Use the Microscope. A Guide for the Novice. By the Rev. Charles A. Hall. New York: The Macmillan Company, 1912. 12mo.; 88 pp.; illustrated. Price, 75 cents net.

The author has written several charming little books designed to conduct the tyro into the fields of Nature by the pleasantest possible paths, and in "How To Use The Microscope" he places the beginner under another debt of gratitude No attempt is made to describe other than inexpensive instruments and the preparation and elementary observation of common objects But within its particular scope the primer thoroughly fulfils its mission, and both matter and illustration are commendably attractive and informing

Key to Trees. By J. Franklin Collins and Howard W. Preston. New York: Henry Holt & Co., 1912. 16mo.; 184 pp.; illustrated.

This is an admirable little guide that will be hailed joyously by the tree lovers of the northeastern United States and adjacent Canada It is substantially bound, small enough to slip easily into the average pocket, and carries a wealth of illustration upon a very good quality of paper The identifications are for the most part based upon leaf characters, but a good cut of the bark is generally added Few technical terms are used, and these are defined in a glossary. The common names are given in full-faced type, the scientific names in italics There is also a systematic list of trees grouped in families, and a general index to tree names. The size of leaves is clearly indicated by an inch scale, placed beside each outline drawing, and six inches, divided into eighths, are marked off in gilt on the back cover of the book, so that comparisons may readily and conveniently be made

The Expert Wood Finisher. A Complete Manual of the Art and Practice of Finishing Woods by Staining, Filling, Varnishing, Waxing, etc. By J. Ashmun Kelly Malvern, Penn.: The Master Painter Publishing Company, 1912. 8vo.; 339 pp. Price, $3.

Maintaining that much of the charm of modern architecture lies in the use of natural woods, the writer endeavors to show how their rich variety of grain and coloring may be developed and preserved. The woods and the fillers used are described at length, and directions are given for ordinary finishing, for finishing and fuming oak, for veneer work, and for French polishing. Stains and staining constitute an important division of the manual, and a wealth of practical formulæ is presented Varnishes, their make-up, tests, and uses, is another capably-handled branch of the subject Instruction for renovating old furniture and on the treatment of stains and spots brings to a conclusion a very useful exposition of an important art.

VII.—Shall My Boy Become a Naval Architect?

By John Ritchie, Jr.

*[This is the seventh of a series of articles intended to set forth fairly the business possibilities of the technical professions. The articles are prepared by men who are connected with the more important technological institutions of this country and who are for the most part prominent educators. Because these teachers have instructed hundreds of young men in the principles of engineering, they are best qualified to write upon a subject so immensely important in the future development of American manufacturing industries.—*Editor.*]*

THIS was the question asked the other day of Prof. C. H. Peabody, head of the Department of Naval Architecture and Marine Engineering at the Massachusetts Institute of Technology. To him there have come young men, grown men, naval officers, from the nations of Japan and China that are developing their navies for the first time, and have sought the best instruction, the former being represented by an officer who was on the staff of Togo in the war with Russia, while no later than the school year that has just closed an ensign in the Chinese navy was one of his students with others of his countrymen. Then again the United States, recognizing the standing of the department that Prof. Peabody is maintaining, has made it a law that the graduates of Annapolis who are to become naval constructors must come to the Massachusetts Tech for two or three years for the finishing touches.

First, it seems worth while to note briefly what is meant by naval architecture and naval engineering. This is due to some of the changes continually effected in this busy world. When ships were of wood and the towering poops and forecastles of the three-deckers were susceptible of architectural treatment, the relation to architecture was self-evident. Now that ships are built of steel and crammed with machinery the relation to engineering is unmistakable. But at all times from its artistic side the designing of ships and especially of yachts, has never failed to appeal to those who consider the ship as something more than a mere conveying or fighting machine.

The adaptation of engines to ships, the increase in the functions that machinery are expected to fulfil, the growth in size and complication, and the more precise fitting of the vessel to its work have called more and more for a stronger grasp of principles by the architect as well as greater specialization by the engineer. And the story does not end here for the yards may be adapted each to its own work, some for warships, others for peaceful passenger greyhounds and others still for capacious freighters, while towboats, torpedo craft, yachts and motor boats are calling to-day for extended further specialization.

It may thus be seen that the field is wider than appeared at first, that there are opportunities in large number for the employment of technically trained men.

"The first reason why a young man should become a naval architect," said Prof. Peabody, "is because he wants to, but he must be intelligent, competent and willing to work." The suggestion of this successful professor followed the lines that the designer of ships and yachts, especially the latter, must have a combination of artistic sense and constructive ability, which will find its natural outlet in ship building. Such a person should be allowed to follow his natural bent. There are always a reasonable number of young men in the community who could be successful naval architects if not discouraged by parental caution.

"A second reason," continued Prof. Peabody, "is because there is a much wider field to which the graduates of such a department should go than the public realizes. Anyone who expects to have to do with the designing, building or managing of ships or building marine engines or motors for boats, will be better fitted if he takes a course in naval architecture and marine engineering." The fact is that this profession broadens the knowledge of the man who enters it. It is doubtful whether any other one calls for an intimate knowledge of so many different industries, for practically all the trades are represented in the modern ship. The design demands a knowledge of abstruse mathematics combined with data obtained from experimental work, and not the least important factor, particularly in the use of what are called "indeterminates," is that rare quality, good judgment, and this is developed by the study. Then the naval architect must be conversant with shop work in all its branches and with steel manufacture, foundry practice, steam engineering and electricity. It is indeed a broad education that is the foundation stone to success in naval architecture.

"Such a course combines the advantages of broad study in engineering," this leader in naval educational work went on to say, "including civil and mechanical engineering with the concentration on a special profession, and in particular the study demands all the advantages in the way of equipment that a large and powerful technical institute alone can furnish."

Then there is the advantage of close personal contact with the teacher in comparatively small groups of students. It must not be forgotten that although the ships of the sea represent the outlay of great capital, they can be counted as but small when compared with the enormous engineering enterprises of the land. It is, therefore, true that while the great demand for land engineers is scarcely supplied by the output in graduates of the great schools, relatively small departments and in comparatively few schools will suffice to supply the need for naval architects. There is room in the naval world for all who are now taking the course, there will be room in the future for an increased output, but there must always be the smaller groups of naval students and the consequent closer touch with the teachers.

Experience has shown that the work of the course really appeals powerfully to all young men who have any taste for the sea or for ships, and they evince an active interest in the work. "They learn to strive hard without feeling the tedium of uncongenial work. This of itself is a most valuable education, and many young men who have intended to go into business have taken the course because they liked it."

There must, of course, be considered the business opportunity for members of the profession. This, according to Prof. Peabody, is good. There has for several years been a larger demand for graduates than the school could supply, and this year there were two or three opportunities for each man who graduated.

Most important in the whole consideration is the fact that a brighter day for ship building has already arrived, and the future cannot fail to show an increase of opportunity. The men manning British shipping are now evincing great dissatisfaction with the miserable conditions of the present day and are likely to demand higher pay and other changes which will tend to lift the life to a level where it is possible for it to attract Americans, especially those who like that kind of life, and there are besides special futures for yachting and motor boating which already begin to cut important figures.

Provided he is intelligent, competent and diligent, for the young man who is willing to devote himself to his studies there are at this moment excellent opportunities in naval architecture and marine engineering, and these opportunities are sure to increase in the future.

INQUIRY COLUMN

Inquiry No. 9279. Wanted a machine for shredding asbestos board.

Inquiry No. 9280. Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears.

Inquiry No. 9281. Wanted to buy machinery for bleaching walnuts and ivory nuts.

Inquiry No. 9282. Wanted name and address of manufacturer of coin-controlled gasoline-dispensing tanks for automobile use.

Inquiry No. 9283. Wanted name and address of dealers in powdered Cocoa and Kola nuts in bulk.

Inquiry No. 9284. Wanted a plan for washing, screening and loading gravel for concrete purposes.

Uses of Cement in Sculpture

(*Concluded from page 196.*)

and the steel reinforcing tower, 8 feet in diameter, was built in its place. This tower ran the entire length and ended in a dome just below the neck, and was designed to support the head and shoulders of solid cement. Thirty-eight 1-inch twisted steel rods were cemented 2 feet into the solid rock with molten brimstone and red hot sand. This was done, not to anchor the statue, but to steady the steel reinforcing cylinder. Twenty-four rods were used in the circular tower; 14 anchor rods passed up through the folds of the drapery, joined the structure of the dome and then passed up into the head. This had to serve as a scaffold from now on and retain its form.

For the circular reinforcing ½-inch twisted steel rods and ¼-inch galvanized wire was used. The diameter of the tower was expanded, one wire placed on the inside and one on the outside, and twisted between the rods until tight, thus reducing it to its original diameter.

The solid concrete base (measuring 18 by 18 by 3 2/3 feet) was cast on November 10th. Maintaining a water supply was one of the chief problems of the work. The water had to be pumped up from the river below to a 5,000-gallon capacity storage tank, made in the ground near the statue, then lifted into another tank with an improvised water jet; here it was steam heated for mixing the cement.

An opening was left in the base below the ground, and six sections of the specially designed, collapsible metal inner forms, 7 feet in diameter, were taken in and set one on top of the other and joined together with taper dowel pins. Then on November 14th and 15th the pedestal was cast to within 6 inches of the figure.

Preparations were then made for casting the figure. An improvised derrick with grooved wheels was set over the mold with the hoisting tub working on the inside of the figure. The forms were taken off the pedestal and a chute put in to convey the cement from the mixer to the bottom of the shaft into the hoisting tub, and a small radiator was used to heat the inside of the mold. The first attempt was made to cast the figure on November 29th, but this was unsuccessful owing to inadequate preparations for zero weather.

It has frequently been asked why the final and most important work was not done sooner and in more favorable weather, or left until the following spring. It must be remembered that the whole operation of building a heroic statue in cement was an experiment, and could progress only as each new difficulty, which arose in connection with it, could be overcome. Delay in the material first used was perhaps the main reason for retarding work. Taking into consideration the action of freezing weather on water-soaked plaster, the prominence of the location of the statue, and the terrific wind storms which would sweep around it during the rest of the winter, it was imperative that the building be completed, to avoid a repetition of the first year's work.

Another 16 horse-power steam engine, four large tubular radiators, and one 20-foot steam coil were procured. A 30-foot gravel bin, 5 feet high, was made and the steam coil placed inside it, on edge. The four radiators were placed inside the scaffolding near the mold. The engine being considerably lower, everything was steam connected, and the pipes boxed, with return to the boiler. A system was also devised for warming the water which was being pumped up from the river. The whole construction was inclosed by canvas and sheet tin, all holes plastered shut, and after a final tryout the work began again on Tuesday, December 20th, 1910, at 5 P. M. The thermometer indicated 2 degrees below zero. Two crews of fourteen men each were employed for day and night shifts.

After all the preparation and trials it was a sight never to be forgotten—the two steam engines belching forth thick smoke and flame; the frozen chunks of

being thrown into the bin and shovelled out piping hot below; the water boiling, a full steady stream being pumped from the river; the hoisting signals; a typical western blizzard blowing; and above all, the men, contented and happy, working away with clocklike regularity, each at his assigned task.

The granite screenings were kept separate from the other concrete by inserting a row of tins 2½ inches from the mold; these were raised as the work progressed. When a form was full the lowest section was collapsed, hoisted and set on the top section until nineteen sections had been hoisted.

A large hole was cut in the back of the shoulders. The metal form (7 feet in diameter) for the dome was hoisted on the outside and slipped into place, the bucket was changed for outside hoisting, reinforcing rods for the dome were wired into place and a form was built between the dome and the window on the arms.

The work now progressed very slowly, so as to give the cement on the dome a chance to set and help support the thirty tons of solid concrete being placed above it. The only breakdown occurred at 3 A. M. on the last day of the work. With the temperature below zero, both engines suffered a temporary breakdown for half an hour, and all but froze the cement which was then on a level with the eyes. At this stage the cement was passed up in pails. On December 30th, 1910, at 2:45 P. M., the huge mold was full. Heat was applied for two more days and then the Spirit of Black Hawk, as the statue is often called, was left to the elements until the following spring.

I think the most exciting time in making a statue—and I am sure all sculptors and bronze founders will agree with me—is the moment when the mold is about to be chopped off. Will it come out perfect or not? Needless to say this part of the work had to be investigated as soon as the weather permitted.

In the early spring a party of three, Mr. Lorado Taft, Mr. Wallace Heckman, attorney for the University of Chicago, and upon whose land the statue stands, and I, investigated the result of our labor. I took photographs from a scaffolding as the piece-mold was taken off the head and shoulders. So far the result was entirely satisfactory.

Two weeks later the rest of the mold was taken off by splitting it from top to bottom and prying it off in huge slabs. At last there emerged a perfect—except for a few minor defects—monolith cement statue.

Practising Efficiency and Knowing Costs

Abstract of a Letter to a New England Manufacturer

By Harrington Emerson, Efficiency Engineer

DEAR SIR: In compliance with your request of last week, I give you herewith the substance of my remarks on practising efficiency and knowing costs.

In the operation of any undertaking one may attain high efficiencies and know little about costs, or one may know all about costs and practice no efficiencies. *Which is more important?*

When I was manager of a glass works I occasionally took Sunday dinner with a French glass-blower. Such meals for flavor and savoriness I have never eaten anywhere before or since, not even in the best restaurants of Paris, London and New York. The wife who cooked and served the meals was a French peasant woman, unable either to read or write. Her husband gave her $20 a month to run the table. She could scarcely count, so she would buy one thing at a time and pay for it, receive the package and change and then buy another item. She also had a garden full of marvelous vegetables and herbs. My! but she was efficient as to quality; she did not pay more than she ought in price nor did she buy table salt mixed with corn starch at $0.10 a pound when rock salt at $0.02 answered the purpose as well. My! but she was efficient as to quantity; she did not buy more than she needed nor did she ever use more than enough. This peasant woman did not know anything about cost-keeping, but she was a born and trained manager, practising that French thrift which has made the French nation one of the richest in the world.

I also knew a young American who had "system" on the brain. He subdivided his expenses under a great number of heads. He did not have a very large income—had to earn or beg or borrow it. He would pay any price that sellers asked, and he bought fourteen-dollar shoes when three-dollar shoes would have answered. He had twice as many suits as he needed, and he got very little use out of them. It was the same with food, with lodging, and with travel. On trains he paid extra fares, took the drawing-room, but spent most of his time in the buffet car. My! but he was inefficient; paying more than he should for everything, using higher qualities, buying more, using more than he should. Yet his accounts were beautifully drawn up in blue and red and green inks as well as black.

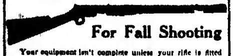
Which quality is more important in running a plant, *efficiency* or *system?*—the efficiency of the Scotch, the Quakers, the Yankees and the Swiss, or the system that balances up United States expenditures to a cent and spends in proportion to what it gets four times as much money as the Swiss Republic?

No doubt there are efficient French managers who know how to read and write and figure. No doubt there are systematic men who also practise efficiency, but the point I wish to make is that *efficiency and system are totally different and that efficiency is by far the more important of the two.* If I knew that every part of a plant I was managing was being operated at 100 per cent efficiency, detailed costs would be relatively unimportant. To know every cost, yet not know what the efficiency is, whether high or only 50 per cent, is as reckless as to run a steam boiler without safety valve or steam gage, trusting that it will not blow up.

Efficiency is the relation between *what is* and *what ought to be.* To determine what actual costs are is a clerical task, but this helps very little if we do not know what costs ought to be. Also, even if we are told what costs ought to be, it requires all sorts of skill to attain the ideal.

We may be running a foundry in which our castings cost $2.75 per hundred pounds. We may know that in another foundry similar castings cost $1.75 per hundred pounds. In such cases it is very usual for the superintendent to blame the equipment, to assert that if he had a new foundry with new equipment he could undoubtedly surpass the rival. It is also quite usual for the owners to blame the superintendent or the equipment and to advocate a change. Nobody knowing where or why the losses occur, everybody blames somebody or something else. If the where and the why are known, a thousand-dollar investment might cut the cost to $1.75. If the facts and remedies are not known, the emotional expenditure of $100,000 might run the cost up to $3 per hundred pounds. There is, therefore, a great difference between the relative importance of cost determinations (only a fraction of the efficiency principle of "Reliable, Immediate, Adequate and Permanent Records") and the skilled experience that can determine fair standards, and there is also a great difference between the analytical ability to determine fair standards and the executive ability and skill to attain them.

To illustrate from horse racing. The ancients five thousand years ago raced horses. Although it would have been very easy to have raced over a measured course and to have timed the speed by an



hour glass, a water clock, or by the beats of a pendulum regulated to an hour glass, it does not seem that even these elementary records, corresponding to cost accounting, were applied until about one hundred years ago. After thirty years of records as to trotting horses, one or two men who had given the subject life-long practical study set the extreme achievement of the trotting horse at two minutes. It took forty years more of intense refinement of track in shape and surface and banking, intense refinement of shoes and harness, intense refinement and improvement of sulky, intense and special skill on the part of driver as well as immense betterment in the physical welfare and training of the horse to realize two minutes out of the most carefully and selectedly bred horse.

Efficiency work is not overhead expense. It is a productive department whose motto is "Wealth from Waste." An efficiency department is inexcusable unless it yields in gain even the first year several times what it costs. If there is a big loss due to inefficiency, it may cost anywhere from $5 to $50 to rescue $100. If the plant is a small one the percentage of cost to saving is naturally higher than if the plant is a large one, though an efficiency scheme in its elements is essentially the same for the little plant as for the big one. Even if in a little plant an expenditure of $50 yields only $50 *net* profit, it is after all a remarkably productive investment.

The largest part of the value of the efficiency counselor is that he knows what *not* to do. If a chicken is put in a cage or maze from which it can escape only by taking one course out of a hundred, it will take it half a day of anxiety, of fluttering, before it accidentally strikes the right combination and gets out. If put back again it takes a shorter time to get out, and finally by not taking the wrong paths it makes its way out in a few minutes. Its improved efficiency is due to the omission of mistakes.

Any one can open a tumbler lock if he knows the combination. If he does not know it, the chances against hitting it by accident are many, and this alone constitutes the safety of the lock.

So, too, in efficiency work, there are a score of things that must not be done for every one that must. It requires thorough knowledge of efficiency principles and long experience in their application to know what "not to do," and in knowing these pitfalls lies success in applying efficiency principles.

Very truly yours,
HARRINGTON EMERSON

How Much Bread Will a Given Quantity of Flour Make?

FEW people, other than the bakers, have even the most remote idea of how much bread a barrel or any other quantity of flour should yield or how much more one brand will make than another. This is a much more important matter than the mere question of whiteness of the bread, or even of its real or apparent lightness. For some brands and lots of flour are much drier than other kinds, and will absorb much more water to bring them to the same degree of dryness as other brands, or other lots of the same brand. Further—and what is of much more importance—the quality of gluten contained in the flour, which is the more nourishing of the two principal constituents, determines much more largely than does the starch, the amount of water that the flour will take up. The best should be the cheapest, if the amount of bread made per pound under the same conditions is proportionately greater than the price demanded therefor. I happen to have on hand data concerning two well-known American brands, namely, "Gold Coin" and "Seal of Minnesota." From the former, a good baker or housewife can make about 345 pounds of dough per barrel of 196 pounds of flour, that is, 176 pounds of dough per 100 pounds of flour. Of the second brand, the figures at my disposition show 168 pounds of baked bread per 100 pounds of flour.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 11.] NEW YORK, SEPTEMBER 14, 1912. [PRICE 10 CENTS $3.00 A YEAR

The Düsseldorf Exposition of City Building

By Our Berlin Correspondent

TOWN planning as an art is of quite recent date. In olden times towns were mainly shelters against the attacks of outside foes and accordingly were encompassed by walls into which the inhabitants of the surrounding districts would crowd on the approach of the enemy.

As there are now no walls to hinder the expansion of cities, and modern rapid transit systems permit of covering great distances quickly and cheaply, modern cities are seen to extend their suburbs like tentacles a long way into the country, deriving from the latter an inexhaustible store of vigor and health. The country used to come to the town; now the town goes out into the country. Moreover, the crowded network of narrow streets devoid of any trace of verdure is more and more replaced by regular systems of broad and well planned streets, leaving plenty of space for private gardens.

In view of the increasing importance attached to this problem the Exposition of City Building, organized by the city of Düsseldorf on the Rhine, would seem to be of more than passing interest. The idea of this exposition had been suggested by the decision of the City Counsel to call for a general competition for the building of Greater Düsseldorf, the outcome of extensive incorporations of neighboring communities. It may be said that Düsseldorf, the old and quiet town of art and gardens, had, with surprising rapidity, become an industrial center of nearly 400,000 inhabitants. It was intended to exhibit such plans of modern city builders as would be received in connection with this competition, but in order to avoid any one-sided presentation of the subject, the municipality invited all the more important communities of the western provinces to participate in a city exposition comprising all fields of communal life. This invitation was sent out to all townships having more than 10,000 inhabitants in Rhenania, Westphalia and Hessen-Nassau, as well as to some firms more directly connected with communal life. The Düsseldorf Exposition thus is a joint intercommunal enterprise of the towns and cities of Western Germany which in its conception is entirely new. About 600 exhibitors are showing nearly 4,000 different objects grouped under City Building, Sanitary Arrangements, Hospital Management, Civil Engineering, and Industry.

With its historical and modern town pictures, its models and photographs of remarkable monuments and buildings, old and recent, its reproductions relating to the designing of streets and drainage plants, gas and water supply, the exposition is nothing short of an illustrated history of German towns and is bound especially to appeal to those concerned with the character of modern towns and their manifold tasks from a social, educational and sanitary point of view.

The Department of City Building presents in 37 rooms a number of solutions of town-planning problems. The town of Hamm, Westphalia, illustrates by means of two relief maps corresponding to 1910 and 1916, respectively, the contemplated improvements of its street system entailed by the partial shifting of the river Lippe and the construction of the Lippe canal, the costs of this improvement work are estimated at $7,000,000. A large model illustrates the street improvement recently commenced in the Hansastrasse at Dortmund

Another scheme shown at the exposition, which is likely to arouse universal interest is the contemplated installation of a network of roads 21 meters (69 feet) in minimum width, affording a connection as straight as possible between the various centers of industry, and dealing with street car as well as carriage traffic. These roads are even to be continued beyond the industrial district proper, as far as Aix-la-Chapelle and Cologne and the Sieg district.

An important department coming under the head of "Sanitary Arrangements" is that of drainage plants and the purification of sewage Hamburg had long been the only German town having a well controlled drainage plant, until in the sixties of last century the towns of Frankfurt-on-Main, Stettin, Danzig, Berlin and others at last realized the importance of such installations

Included in the exposition are all the different systems of drainage, many schemes, general and specified, of plants of different dimensions on the mixing and separating systems, mechanical cleaning and settling tanks as well as plants designed on the biological and oxidation processes, special plants on the Emscherbrunnen system and some minor settling plants for industrial works, hospitals, etc

A kindred problem is the cleaning of streets and the refuse disposal The divers ways and means available in this connection are most adequately illustrated, thus affording to engineers a welcome opportunity of study and to the man in the street an interesting insight into a field yet insufficiently known The city of Dortmund, for instance, shows an installation for the collecting and loading of domestic refuse destined to be transported to some distance and for the cleaning of dust-bins on the alternating system. A large-scale refuse sorting plant connected with agricultural operation is exhibited by a refuse utilization company Pictures and actual models of refuse destructor plants are shown by some of the most important cities of Western Germany and by many engineering firms.

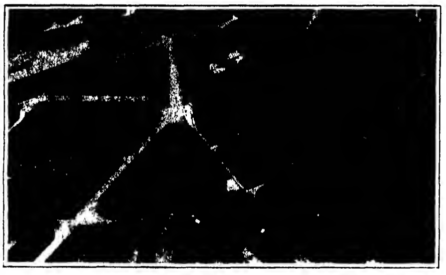
Communal and private hygiene, inclusive of the installation of baths, sanitary plants, heating, disinfection, school hygiene and other sanitary arrangements, constitute another department. Maps, illustrations and models of widely differing bathing establishments from the simple douche to the large swimming tanks and the most modern achievement, viz., riverside "beaches," are among the more important exhibits of this part of the exposition The economical and hygienical disposal of the dust of our dwellings has for the general health an importance which cannot be overrated.

Other exhibits of interest are those relating to the destruction of rats and gnats and on the other hand to the protection of animals The various arrangements for the treatment and prevention of disease form a special group showing in a most comprehensive manner the management of modern hospitals, as well as the provision made for the prevention of epidemics and the protection of infants

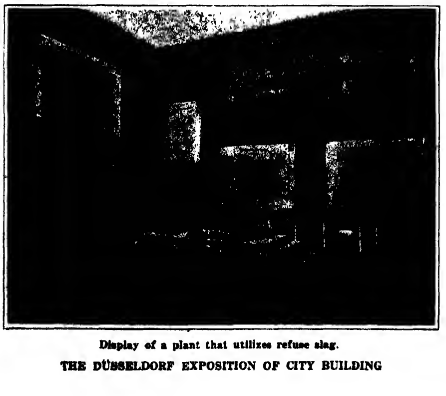
The department of Civil Engineering comprises plans and models of public and industrial buildings, railways, bridges, etc. The department of Industry finally reviews the development and status of the industry of Western Germany in its various branches and therefore resembles the ordinary industrial show

Exhibit of the municipal schools of domestic science.

Model of the city of Hamm and its environs.



Suggested plan for a town with plenty of garden space.



Display of a plant that utilizes refuse slag.

THE DÜSSELDORF EXPOSITION OF CITY BUILDING

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, SEPTEMBER 14, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid.	3.75

The Scientific American Publications

Scientific American (established 1845)	per year,	$3.00
Scientific American Supplement (established 1876) .	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Good Roads and National Defense

WHATEVER benefits of a military character may be derived from the recent army maneuvers (and they will doubtless be many) the operations have had the much desired result of drawing attention forcibly to the necessity for good roads as a part of the system of National defenses. The *Army and Navy Journal* states that there was one opinion shared unanimously by Army and National Guard officers who took part in the Connecticut maneuvers. It was that the roads of that State, with the exception of some of the main turnpikes, are not what the roads of so old and advanced a State as Connecticut should be. We are told that in the event of war and a heavy fall of rain, the side roads would be almost as impassable as the Virginia dirt roads were during the Civil War. The necessity for good roads is emphasized by the fact that the country is hilly; and those of us who have had occasion to travel through the State know that some of the hills are both steep and long.

The defensive maneuvers in Connecticut proved once more that good highways are absolutely necessary for the rapid disposition of troops. Napoleon understood this fact, and his system of military roads is one of the finest monuments left by this soldier-engineer. It is not to the point to say that railroads, which were unknown in Napoleon's day, are available now; for while the railroads are excellent for the conveyance of large bodies of troops quickly over long distances, we must remember that the majority of the movements of troops, especially in tactical movements, must be made over the State and country roads.

The Gordon Bennett Cup Race

IF the Gordon Bennett Cup race taught us anything it taught anew the lesson of America's backwardness in aviation. Prizes of ten thousand and fifteen thousand dollars had been offered by clubs for a cup defender. The response was discouraging to say the least. Gallaudet made a splendid effort to comply with the Aero Club of America's conditions by designing a machine which is in every way a credit to American ingenuity, but which sustained a severe accident a few weeks before the race. That a nation of ninety million people supposedly possessed of considerable wealth and interested not only in sports but in the most recent developments of mechanics should produce but one Gallaudet is hardly to its credit. But when that nation is more or less in honor bound to live up to the traditions of a Langley, who gave the world the first motor-driven aeroplane model, and of two Wright brothers, who gave the world the first man-carrying motor-driven flying machine, what can be said in defense?

To France belongs the credit of having displayed the greatest interest, not only in the Gordon Bennett race, but in the industrial side of aviation as well. From the very beginning the Gordon Bennett race has been a kind of milestone which marked the progress of French designers. True, in years past the race has been won by Englishmen and Americans, but the French really deserve the credit, for, with one exception their machines and their motors carried the pilot to victory. The only formidable competitors of Curtiss in the now historic contest of 1909 were a Blériot and an Antoinette machine. In 1910 the Blériot and Antoinette monoplanes were again in evidence, but improved in design and equipped with motors of higher power. In 1911 a Nieuport, a remarkable machine in every way, carried off the honors. This year the Frenchmen appeared on the scene with two Deperdussins of 140 and 100 horse-power, respectively, and a Hanriot of 80 horse-power. In the elimination trials held on July 13th last, these three machines developed amazing speed. The 80 horse-power Hanriot made 145 kilometers (90.09 miles) per hour; the 100 horse-power Deperdussin, 164.338 kilometers (102.11 miles) an hour; and the 140 horse-power Deperdussin, piloted by Vedrines, 169.81 kilometers (105.51 miles) an hour. Even the machines of Grahame-White and Hamel are French; for Hamel's monoplane is a true Blériot and Grahame-White's a Nieuport, for all its English pedigree.

It seems distinctly wrong to credit the man rather than the machine for a Gordon Bennett victory. Without disparaging in the least the courage and the skill displayed by the men who pilot monoplanes that cleave the air at one hundred miles an hour, surely it would be more fitting if the designer and manufacturer were to receive some of the credit. Why should not the rules stipulate that each country shall be represented not only by one of its citizens, but by a citizen seated in a machine made in that country?

A New Parcels Post

IT is gratifying to note that at last the Congress, before its final adjournment in August, passed almost unanimously an amendment (Section 8) to the Post Office Appropriation Bill (Public No. 336) providing for three kinds of parcels post, two of which are to have a weight limit of eleven pounds, and one a weight limit of four ounces, at different rates, to become operative January 1st, 1913.

The present parcels weight limit of four pounds is thus extended to eleven pounds, and conforms with that of several foreign countries. Fourth class mail matter is to embrace all other matter, including farm and factory products, not now embraced in either the first, second or third class, not exceeding eleven pounds, nor larger in size than seventy-two inches in length and girth combined, and not likely to injure in form or kind the person of any postal employee or damage the mail equipment or other mail matter and not of a character perishable within a period reasonably required for transportation and delivery.

The postal rate of this class is to vary in amount according to the distance the parcel is to go. This, we believe, will be the most vexatious and annoying feature of the new plan, and contrary to the purpose of our general postal usage, that is, one rate regardless of the distance traversed. The country outside of the Philippine Islands is to be divided up into units of area thirty miles square, which forms a so-called "postal" center, and postal maps or plans are to be put up everywhere showing the location of these numerous centers. The immediate place where the sending party happens to live is called Zone No. 1, and within a radial distance from the center of this zone of 50 miles a package weighing one pound or a fraction of a pound can be sent for five cents and three cents for each excess pound or fraction of same.

Zone No. 2 includes a radial area of 150 miles from the center of Zone No. 1, with a rate of six cents for the first pound or fraction of same and four cents for each additional pound.

Zone No. 3 includes a radial area of 300 miles beyond the center area of No. 1, with a rate of seven cents for the first pound or fraction of same and five cents for each additional pound or fraction thereof.

Zone No. 4 includes a radial area of 600 miles from the center area of Zone No. 1, with a rate of eight cents for the first pound or fraction thereof and six cents for each additional pound or fraction of same.

Zone No. 5 includes a radial area of 1,000 miles from the center area of Zone No. 1, with a rate of nine cents a pound or fraction thereof and seven cents for each additional pound or fraction of the same.

Zone No. 6 includes a radial area of 1,400 miles from the center area of Zone No. 1, with a rate of ten cents for a pound or fraction thereof and nine cents for each additional pound or fraction of same.

Zone No. 7 includes a radial area of 1,800 miles from the center area of Zone No. 1 with a rate of eleven cents for the first pound or fraction thereof and ten cents for each additional pound or fraction of same.

Zone No. 8 includes all territory from the center of area of Zone No. 1 beyond the 1,800 miles of Zone No. 7 and any portion of the United States, District of Columbia, Philippine Islands, and United States Territories at rate of twelve cents a pound or fraction of a pound and twelve cents for each additional pound or fraction thereof.

An appropriation of seven hundred and fifty thousand dollars was made to defray the cost of special equipment, maps, stamps, directories, etc., and the Postmaster-General is given authority to [illegible] the rates subject to the approval and consent of the Interstate Commerce Commission, [illegible] to insure sufficient revenue [illegible] cost of the service.

The Postmaster-General is also authorized to provide indemnification of shippers, for shipments [illegible] or lost, by insurance or otherwise, and [illegible] for the collection on delivery of the postage and price of the article sent, and to fix the necessary charges.

There is provided also a rural free delivery and local parcel post for delivery on a route from one person to another or to the central post office limited to a weight of eleven pounds for a single parcel with a rate of five cents for the first pound or fraction thereof and one cent for each additional pound or fraction of same.

The third kind of parcels post is unrestricted as to territory limits, and is general in its operation, but the weight limit is four ounces, and the rate is one cent per ounce or fraction thereof. This rate is the same as the existing parcels post.

There is no doubt of the success and value of this new parcels post legislation, and it will certainly advance the interests of all manufacturers throughout the country.

The International Congresses

WE had occasion last April, at the time of Dr. Eijkman's visit to America, to comment on the movement for internationalism in science. The subject is once more brought to public attention about this time by the meeting of no less than three important international congresses in this country within a period of three or four weeks. Of these, the first in chronological order is the sixth congress of the International Association for Testing Materials. The purpose of this organization is well brought out in the words of the opening address by Dr. Howe: "The function of the testing engineer is to stand between the public and the manufacturers who supply that public, to test the fitness of those supplies, to measure accurately their degree of fitness and to reject unsparingly the unfit. He is a guardian of those who travel by land or sea and of those who live or work in buildings of important size. He is the protector of the material interests of the public, because in the last analysis all structures and all materials of which they are made are for the use and benefit of the public, individually and collectively, and are paid for directly or indirectly by that public.

"To make this work of the testing engineer more effective, to guard the lives and the interests of the public, is the object of the association's existence. It is an open court in which the public sits in judgment on the various methods of testing."

An event which calls for our very special attention is the assembling in Washington and New York of the Eighth International Congress of Applied Chemistry. Something of the scope covered by this meeting may be gathered from the fact that the advance copies of the papers to be read fill no less than twenty-four octavo volumes. Some of the most significant of these will appear in the pages of our SUPPLEMENT. Yet the most important function of such a congress is not the presentation of papers, but rather the opportunity it affords for the direct interchange of ideas between the members attending.

And, thirdly, during the last week of September there will meet in Washington the Fifteenth International Congress on Hygiene and Demography. To say that the subjects treated are of vital importance is to use in a literal sense an expression which has become weakened by its over-frequent application as a figure of speech. After all, though in the mind of the technical man industry and commerce naturally are uppermost, these things are merely means to an end—methods of ministering to our welfare—and it is true for the community as for the individual that health is of greater importance than wealth.

The month of October also brings two international congresses to our continent. The Seventh International Dry Farming Congress will be held at Lethbridge, Alberta, October 21st to 26th, 1912. In connection with it will be held the International Congress of Farm Women. A feature of the meeting will be an agricultural show, comprising exhibits of farm products grown without irrigation under a rainfall of not more than 20 inches per annum. These congresses are attracting more and more attention throughout the world. To the sixth, held last year at Colorado Springs, thirty foreign countries sent delegates. Dr. John A. Widtsoe, president of Utah Agricultural College, is president of this year's congress, which will be the first held outside the United States.

It gives us, as Americans, no small satisfaction to [illegible] to the engineers, chemists and physicians [illegible] from all parts of the earth.

We see in this another sign that in the future America is to become a great center for the advancement of science, pure and applied.

Engineering

[illegible]—The proposed rack railway to [illegible], the [illegible] mountain health resort of the Philippines, is to run from Aringay on the coast via Galinao. A Swiss railway expert has reported favorably on the undertaking and it is hoped to have the line completed and in operation in two years.

The Question of Lifeboats.—The president of the British Board of Trade has appointed a departmental committee on boats and davits to report on the most efficient method of stowing, launching and propelling ships' boats. The committee invites inventors and others to submit suggestions by October 1st, 1912.

Gun-power Engine Economy.—Tests made by Prof. R. C. Carpenter of Cornell University show that the gun-power steam engine, using steam of about one pound above atmospheric pressure and a vacuum of twenty-eight inches, required about thirty-one and six tenths pounds of steam per horse-power per hour. This engine has been fully described in the columns of this journal.

Collier "Neptune" is Rejected.—It is stated that the collier "Neptune," built for the United States Navy under contract, has been rejected on the ground that she does not come up to the government specifications. This ship is fitted with turbines which drive the propellers through the medium of a mechanical speed-reduction gear. We understand that the reduction gear has shown excellent results during the try-out of the machinery; but that the failure to get good all-round results was due to the type of turbine employed.

Canal Open in 1913.—Replying to a communication from the Secretary of the Board of Harbor Commissioners, Los Angeles, Col. Goethals states, that every effort is being made to complete the excavation and the work on the locks of the Panama canal by June 30th, 1913. He expects to see the level of Gatun Lake at eighty-five feet some time in September, 1913. If this be accomplished and the first boat be successfully put through the canal, announcement will be made that it is in condition to pass shipping. This, the Colonel says, will allow of a year's try-out before the formal opening.

Six-inch Torpedo-defense Guns.—The return to the six-inch gun as the principal arm for secondary batteries is a noticeable feature of naval development in these days. When the "Dreadnought" appeared, the secondary batteries were abandoned and dependence was placed upon three-inch and four-inch guns for protection against torpedo-boat attack. Torpedo-boat destroyers, however, have increased so rapidly in size, that a larger gun is necessary to deal with them, and most of the navies have returned to the 6-inch piece; none are using less than the 5-inch or the 4.7 inch.

An Aerial Railway on Mont Blanc.—Aerial railways, which carry their passengers in cars suspended on cables, are the latest departure in the commercialization of the Alps. One of these unlovely but convenient devices is soon to be installed on Mont Blanc. Starting from Chamonix, at an altitude of 3,000 feet, it will ascend to the Glacier des Bossons at 7,500 feet, with two intervening stations. It will have a grade of 50 to 60 degrees. The line will finally be extended to the Aiguille du Midi, at an altitude of 11,500 feet. The first section is to be completed in 1913 and the extension the following year. The road will be worked with three cables—the carrier, the tractor and a cable for the brakes. Each carriage will accomodate 24 persons.

Railways in Morocco.—The Franco-German agreement of last summer concerning Morocco included a pledge on the part of these countries to construct a railway from Tangier to Fez. In general there are no engineering difficulties in the way of railway construction in Morocco and the cost is likely to be small. At present the only railway in the country is a small narrow-gage military line now nearing completion along the Atlantic coast from Casa Blanca to Rabat. All transportation between the coast and the interior is by caravan and is suspended in bad weather, as there are no roads of any sort away from the ports. Wheeled vehicles are practically unknown outside of Tangier and Casa Blanca, and the principal rivers intersecting the caravan routes are unfordable for several months of the year.

The Baro-Kano Railway, in Nigeria, recently completed, links Kano, the most important purely native center north of the equator in Africa, with Lagos, on the coast. The amazing statement is made in a recent consular report that prior to the opening of this railway most of the foreign trade of Kano was carried on by caravans across the whole width of the Sahara desert—especially between Kano and [illegible]—entailing a journey of some [illegible] months in each direction. This trade is now all [illegible] through British territory to Lagos by rail, and [illegible] to European ports—a total journey of [illegible] [illegible]

Electricity

Telephoning from Norway to Finland.—The Swedes are thinking of laying a telephone cable from Marieholm near Stockholm to Abo across the Finnish Bay. The Norwegians are very interested in this proposition as they could also communicate with Finland by telephone. It remains to be seen what the Russian authorities will say to this. The cost is estimated at one half million Finnish marks.

A 175,000 Volt Transmission Line.—On Big Creek, 275 miles from Los Angeles, a large hydro-electric plant is now being built. Current from this plant will be conducted to Los Angeles at a voltage of between 150,000 and 175,000. The gradual increase of voltage used on transmission lines in California is due to the low hygroscopic conditions of the atmosphere. It is predicted that before long voltages of 200,000 and 250,000 may be employed.

Silver-plating versus Nickel-plating.—The automobile industry says *Electricity* (London) is showing a tendency to supersede nickel-plating by silver-plating for the bright parts of motor vehicles. Nickel-plating, notwithstanding its hardness, has the disadvantage that when exposed to the weather it becomes coated with a film of oxide hard to remove. Silver has a whiter color, and is capable of a richer and finer polish. The surface does not peel or corrode, and when tarnished is far more easily polished. The labor cost of plating silver is no greater than for nickel, and as a very thin deposit is sufficient the greater cost of the metal need not correspondingly increase the total cost.

The Selenium Cell as an Aid to the Blind.—An instrument recently exhibited at the British Optical Convention enables the blind to use their ears to detect variations of light. There are a pair of high-resistance telephone receivers and a portable box containing a pair of selenium cells electrically connected to a battery and to the two receivers on a balanced Wheatstone bridge system. A clockwork interruptor gives an intermittent current which causes a rasping sound in the receivers, louder in that receiver and selenium cell circuit which is influenced by the stronger light. Thus a blind man equipped with the device in which one selenium cell faces toward his right and the other toward his left can sense the difference in light on the two sides, which may give him valuable guidance in walking.

The Edison Electric House.—Announcement was made in these columns some time since that Thomas A. Edison was fitting up a house in Llewellyn Park, New Jersey, with an independent electric lighting plant and a complete equipment of electrical apparatus. The purpose of this house is to demonstrate the advantages of electricity to the farmer who is so isolated, that he cannot obtain electric power from a central station. This house is now practically complete and will be open soon to the public. The current is generated by a small gasoline engine which drives a dynamo and the latter in turn stores the current in a battery of storage cells. The particular novelty of the system lies in the simplified means of control, so that the apparatus is rendered absolutely fool-proof and may be operated by inexperienced hands.

Russian Wireless Stations in the Arctic Sea.—Russia has for some time evinced special interest in the Arctic regions, sending out each summer expeditions to Nova Zembla and other parts of Northwestern Siberia, and taking up with renewed energy old plans of a ship connection between Europe and the Estuary of Siberian rivers. Russano, the well-known Russian traveler (in the company of Kushkine, who at the time was a member of Roald Amundsen's expedition) will set out in the spring for Arctic waters, in order, among other things, to find a navigable route to the rivers of Western Siberia. In order to improve and safeguard Siberian navigation, Russia contemplates the installation of radio-telegraphic stations on the northern coast of the Russian continent, as well as in Nova Zembla and other islands.

Bare Aluminium Wires for Coils.—The conductivity of aluminium is about 60 per cent of that of annealed copper. Accordingly, an aluminium conductor must be considerably larger in cross sectional area than a copper conductor if the two are to carry the same amount of current. Aluminium wire is always coated with a thin oxide which serves as an insulator. This insulation is enough, according to some European manufacturers, to permit of using bare aluminium wire in the coils of magnets. As the oxide film is of inappreciable thickness, a coil of fine wire thus constructed would be no bulkier, if as bulky, as a coil wound with insulated copper wire. H. F. Stratton, writing on this subject in the *Electrical World*, states that he has been unable to secure sufficient insulation when depending upon the aluminium oxide film as it naturally occurs in the commercial product. In order to increase this oxide, some European manufacturers wet the coil and then heat it. This he found hardly sufficient, but he has produced very successful results by passing the wire through sodium hydroxide, and then drying the coil by passing a current through it.

Science

Ciudad Porfirio Diaz exists no longer. One result of the new *régime* in Mexico of interest to geographers is the change of the name of this border town (opposite Eagle Pass, Texas) back to its earlier name, Piedras Negras.

Wireless in Siam.—A powerful radiotelegraphic station is about to be erected at Klong Toi, near Bangkok. It is expected to maintain communication with Penang, Singapore, Saigon, Hong Kong, and Manila. The vessels of the Siamese navy are also about to be equipped with wireless.

Prof. Parker and Mt. McKinley.—After an unsuccessful attempt to reach the summit of Mt. McKinley, Prof. Herschell Parker of Columbia University and Belmore H. Brown returned to Seattle on August 28th. It was found impossible to reach a height greater than 20,100 feet in the face of a blinding blizzard and with provisions nearly exhausted.

A New Telescope for Alleghany Observatory.—A 30-inch refractor valued at $150,000 was recently dedicated at the Alleghany Observatory in the presence of a distinguished company of scientists. It is said that the instrument was paid for by subscriptions collected for the last ten years. Among those who officiated at the dedication were members of the Astronomical and Astrophysical Society of America.

Coal Researches in Germany.—The new Kaiser Wilhelm science advancement institution is taking measures to found an institution at Mülheim for carrying on research upon coal and kindred subjects, with the co-operation of the large industries of this region. A large part of the expenses for the buildings will be borne by the municipality of Mulheim. It is also stated, that among recent German enterprises is the founding of an experimental therapeutic establishment at Berlin.

The Radiology Congress.—The sixth International Congress of Radiology and Electrology is to be held at Prague, from the 3rd to the 8th of October next, under the patronage of several Ministers. Prof. Stoklasa, rector of the Upper Technical School of Prague, will preside on this occasion. An exposition of apparatus of various kinds will be one of the features, and the delegates will have an opportunity to visit the Radiological Institute of Vienna and the radium laboratories of Joachimsthal.

Oldest Museum in the World.—Dr. Otto Kümmel, head of the East Asiatic Department of the Berlin Museum of Ethnology, tells of the oldest museum in the world, in the bulletin of the Société Franco-Japonaise. This museum may be found in the city of Nara, the former capital of Japan. Since its foundation, in 756, it went through all the changes of the Japanese Empire without one single addition to its collection. Dr Otto Kümmel is one of the few Europeans who were permitted to visit this museum. It opens its doors but once a year, on a day in spring, when a special committee inspects the collection, and a new list is made out. The museum contains about 3 000 articles, which are said to be the most beautiful specimens of decorative work, which have ever been produced by human hand, such as lacquer ware, decorative furniture, enamel ware, cambric like fabric, etc. The origin of the majority of the articles is uncertain; some came from China and others from Corea, but most of them appear to be of a more exotic origin. All, however, came of a time prior to the year 756.

The Work of a French Hospital Ship.—A recent consular report describes the remarkable work of the French hospital ship "Saint François d'Assise," one of two vessels maintained by the Societe des Oeuvres de Mer to minister to the wants of fishermen of the North Atlantic. The vessel in question cruises on the Newfoundland Banks, while her sister ship plies the Iceland fishing grounds and the North Sea. The hospital ship leaves France each spring and follows the French fishermen to the Banks. It carries a crew of 27 men, including a chaplain and a doctor, and has beds for 36 patients, besides accommodations for shipwrecked sailors and patients suffering with minor ailments. During the summer it speaks each fishing vessel on the Banks, without regard to nationality, to ascertain whether its services are needed. Sick or injured fishermen are given treatment, and when the cases are sufficiently serious are kept on board. From time to time the ship puts into St. Pierre to transfer patients to the French hospital at that place. During the year 1911 the ship steamed 12,209 marine miles, spoke 1,143 vessels, admitted 70 patients to the hospital, and gave treatment at sea in 420 other cases; besides picking up 14 shipwrecked sailors. The vessel also acts as a floating postoffice, under the authority of the French government, distributing and collecting mail on the fishing grounds. No charge is made for medical treatment or for medicines. Besides its two ships the society maintains two sailor's homes, one at St. Pierre and one at Faskrudsfjord, Iceland. It has a small subsidy from the French government, but is mainly dependent upon private subscriptions from year to year.

Grenadiers of the Air

Exploits in Bomb-dropping from Flying Machines

By Major H. Bannerman-Phillips

A grenadier was originally a soldier detailed and equipped for throwing hand grenades. He has long been obsolete. Only his name remains to recall his now historic function. It may be that the flying machine will rehabilitate him. Military men have been conducting experiments to ascertain just what is the destructive effect of explosives dropped from a height by a flying machine. In the campaign bombs have been dropped under actual war conditions. In France, Michelin offered a prize for bomb-dropping achievements, which was won by Lieutenant Riley E. Scott, an American. The following article, written by a British officer who is a recognized authority on the military uses of airships and aeroplanes, shows how much and how little may be expected of the new-fashioned grenadier of the air in the present state of our knowledge.—EDITOR.

THE first thing we have to consider in connection with the use of a flying machine or dirigible balloon for dropping projectiles is: Why we should use the machine for dropping them at all, inasmuch as a gun will send them with far more force and effect, and certainly with greater accuracy of aim.

The answer is that under certain circumstances we cannot produce the destructive or demoralizing effect we require by the aid of artillery, because we can neither see the objective of our attack nor calculate by map or otherwise its probable position with practical certainty; or because, although located by our air-scouts, it is at such a distance from our batteries that a shell will not reach it; or because our aerial destroyers must first locate the objects of attack, and having done so, must act on their own account with dropped projectiles. They would require to take such action when (A) the objective is out of reach of the artillery, (B) the moral effect of the attack (a stampede of cavalry or transport horses in their lines, for instance) can be achieved with a small expenditure of hand grenades, (C) the purpose of the attack is to effect the hasty demolition of buildings, bridges, or stores, by explosion or fire, but these latter are so situated, or so well guarded, as to be inaccessible to men landing from a flying-machine, and using explosives or other incendiary means at the ground surface, or (D) when the object of attack, say a column of troops caught on the march along a causeway or bridge, would get away into safety unless the aerial destroyer acted at once, instead of returning or sending word to the artillery.

There are roughly speaking four classes of targets or objectives against which the dropped projectiles might be used with advantage, other things being equal, and four separate types of bomb would be required for use accordingly:

1. Heavy explosive bombs.
2. Small bombs or hand grenades.
3. Incendiary projectiles.
4. Aerial projectiles.

It will be convenient, to begin with, if we take each type separately.

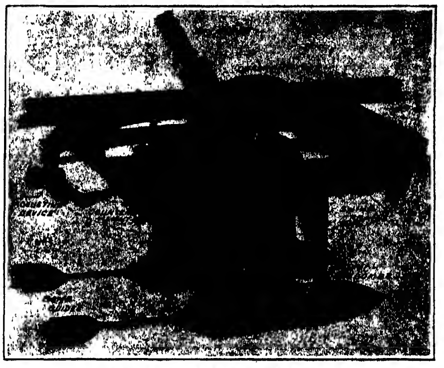
Heavy Explosive Bombs.

These would be used against such targets as dock yards, ships, railway junctions and termini, turntables, and rolling stock, bridges, postal, telegraph and wireless stations, banks, exchanges, telephone and staff offices, War Department and Admiralty buildings, range-finding bases of forts, and other nerve-centers generally. The demolition of these would tend to disorganize traffic (military and commercial) interrupt communication of orders and information, and thus paralyze the fighting forces of a nation, and bring pressure to bear on the civil authorities by cutting off supplies and starving the population.

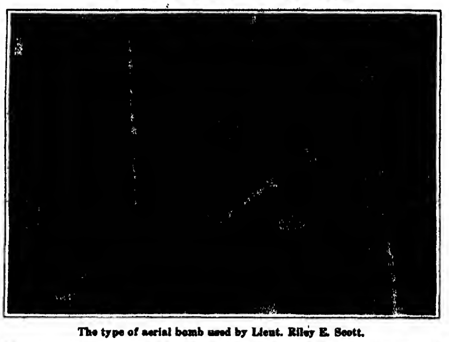
For such purposes as these the projectiles must strike the exact spot. Of the actual result of a charge of high explosive when merely *dropped*—not fired from a gun—and exploded on impact, we do not know much as yet, except that the effect, though great, is probably very local.

Hand Grenades or Small Bombs.

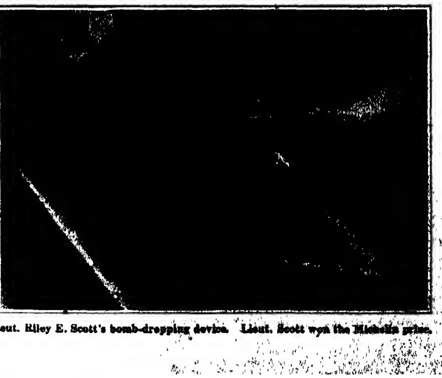
The second purpose to which dropped bombs would be put would be the attack of troops assembled in masses preparatory to extension or advance in small columns for attack; reserves kept in readiness for action under the shelter of high ground, whose position would be difficult to locate without overhead scouting, and against whom distant artillery fire could not therefore be used with certainty of effect; troops marching in columns of route along defiles and hollow roads out of sight of the enemy, but visible to the airman from above and unable to extend quickly to either flank, thus forming a helpless target to overhead fire; transport and ammunition columns on the march; convoys of provisions coming up from the base of supply in the enemy's country to the troops fighting at the front, these convoys being too far off to be reached by artillery and too well guarded in front and flanks to be open to attack by mounted troops moving on *terra firma*; horse-lines, and camps of all arms, the frequent harassment of which by bombs at night would stampede the horses, disturb the well-earned rest of tired soldiers, wear them out, demoralize them, and destroy their nerve.



An instrument for directing bombs from aeroplanes.



The type of aerial bomb used by Lieut. Riley E. Scott.



Lieut. Riley E. Scott's bomb-dropping device. Lieut. Scott won the Michelin prize.

For these purposes hand grenades or small bombs would be sufficient, the aim need not be very precise, and a fairly large number could be carried by one flying machine.

So far the experience of the Italians in Tripoli tends to show that the moral and material effect on troops of bomb-dropping from aeroplanes by day is very small. It has even been said that in some cases the bombs did not explode, and that they were picked up and used against the Italians themselves later on. The latter, however, have not given up the idea, but have been carrying on further tests of the effect of dropped projectiles from dirigibles in Italy and off the coast. Other evidence as to the uses of the small bomb or hand grenade, as thrown from an aeroplane, is scanty and indecisive.

Incendiary Projectiles.

These would be long, hollow, metal cylinders, with solid sharp-pointed steel heads, and with a percussion fuse and a bursting charge in the head, behind the steel point, the remainder of the cylinder filled with an incendiary substance or possibly inflammable liquid, which would burn fiercely on being released by the charge. They would be so weighted and so furnished with flanges, answering to the feathers of an arrow, as to insure their falling head-on, without turning over in the air during descent, the object being to penetrate the roof or outer covering of a building, gasometer, oil-tank, or magazine, burst the charge inside and start a conflagration, or to cover a pile of stores or supplies with burning liquid. These would have to be accurately dropped or they would fail to achieve their purpose.

Aerial Projectiles.

The fourth class of target would be an enemy's aircraft, aeroplane or dirigible, traveling in all probability very rapidly in mid-air, and changing its altitude and direction from time to time in order to baffle the attacker, who to drop his projectile must rise above the object aimed at. There are, of course, projectiles which can be made to overcome the force of gravity and travel horizontally toward the target by their own powers, such as the "aerial torpedo" invented by the Swedish officer, Col. Unge, but for the present we are not dealing with any other than *dropped* projectiles. To damage or destroy a hostile aircraft by this means the airman could use an explosive bomb containing either an incendiary material or fluid, with time and percussion fuse, so as to burst after a given number of seconds, or on striking the target. The percussion fuse would have to be very sensitive, and the intention in this case would be to damage by shock of explosion and fire in the case of an aeroplane, or by explosion of the gas in the envelope of a dirigible.

The Grappling Iron.

Another class of projectile suited for use against either aeroplane or dirigible, though it can hardly be considered a

"bomb," is the javelin or grappling-iron, armed with hooks and blades for tearing and cutting the frame-work, wires, and covering material of an aeroplane, or ripping the envelope of a dirigible and releasing the gas. Dr. Barton, an English expert, has patented a bomb for aerial purposes, which is intended to combine the attributes of the explosive projectile with the ripping and tearing missile. It is of fish-like or stream-line form, with bluntly pointed head, largest diameter at the fore-end, and tapering away to a slender tail which is fitted with helical blades to impart a rotary movement, when dropped head down. The tips of the blades terminate in hooks or cutting-edges for tearing the fabrics of a balloon, dirigible or aeroplane. The bomb may be dropped or projected from a tube mounted on gimbals, and fitted with guides or gages to indicate and influence the angle of descent. A flat vane, like that of a weather-cock, may further be attached to the tail of the projectile by means of a swivel-joint, so that the bomb may rotate without rotating the vane which is normally in the same place as the longitudinal axis of the bomb, that is to say, when the bomb is allowed to fall vertically the vane is vertical and under ordinary circumstances, does not affect the direction of its flight to earth. On the other hand, this vane, at a pre-determined time, by the action of a spring released by clock-work, or a time-fuse, which burns a retaining cord, may be caused to assume a position at an angle with the long axis of the projectile, and acting as a rudder will deflect it from its initial direction more or less horizontally.

The walls of the bomb are perforated and into the holes are inserted peculiarly shaped bullets, which release two or more knife edges, when they are projected from the bomb either by one or more successive explosions internally or by centrifugal force. The bullets are assumed to fly out in all directions and, acting like shrapnel, materially increase the destructive area of the bomb. Further, an explosive may be used to burst the whole bomb and break it up into a number of ripping-and-tearing fragments of metal at any pre-determined time.

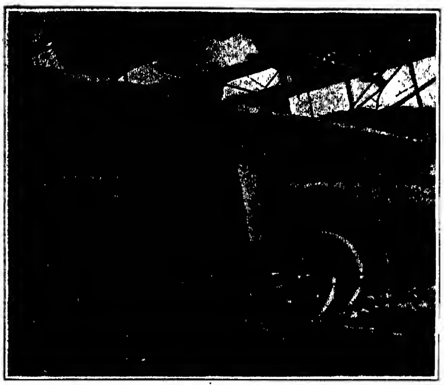
Having described the classification of objectives, which we are likely to attack by bomb-dropping or missiles from aircraft, it is as well to state that in all these cases it is understood that before commencing operations the attacker must be sure that his projectiles, if they miss the target, at least will not be dangerous to his own side. The summary of reasons for using the dropped projectile in preference to artillery, shows that usually these operations would take place over the heads of the enemy's troops or in an enemy's country, but in combats in mid-air between aircraft of any kind the rapidly changing positions of the latter might easily bring them both into the region immediately above our own troops or entrenchments, and we must be prepared to cease fire until the scene of conflict changes to a more suitable air-space.

So far, we have dealt with the dropping of projectiles in connection with the objects to be attained by the process and the kind of bomb or missile to be thrown.

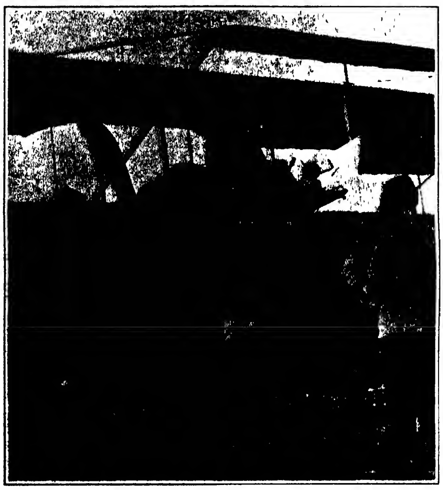
Hitting the Target.

We must now consider the means of securing accuracy in hitting the mark aimed at, and this is by no means so simple a matter as it would seem at first sight, or as it has frequently been represented in sensational literature.

First of all, we have to bear in mind, that however bold, and even reckless of their own lives, the occupants of an aerial machine may be in the interests of their own country and their own forces, they are hardly likely to approach the enemy by daylight unobserved, and an aeroplane is of little use—up to the present—by night. It follows that if they are to achieve their object before being themselves destroyed by artillery fire from below, they must keep at such a height as will give them the best chance of immunity, in spite of the target they offer,



The bomb-dropping apparatus employed by Lieut. Bousquet, who won second place in the Michelin contest.



Lieut. Bousquet seated in his aeroplane in which he competed in the Michelin bomb-dropping contest.

Lieut. Maillefer ready to start on a bomb-dropping flight. The bombs are contained in a trough.

while still able to see clearly what they themselves are aiming at. If the enemy also have aircraft, they have to keep a look out for these also, and though the enemy's gunners may possibly not fire for fear of injuring their own airmen, or their own troops below, by the spent shells and shrapnel, the would-be bomb-droppers cannot reckon on this, and must be prepared to become a target themselves at any moment, a friendly cloud being their only possible cover.

Now it has been proved by actual experience, that bullets from the enemy's rifles struck the aeroplanes of the Italian aviator in Tripoli at a height of 1,800 feet, and 3,000 feet as been suggested as a altitude, which it would be advisable for an airman to remain at, in presence of the enemy, in order to be reasonably immune from damage. This is not to say that he could not be reached by shrapnel or other projectiles, since there are guns which can throw their shell 10,000 feet and more, but taking into consideration the height of 3,000 feet combined with the pace, say 35 to 60 miles per hour, of an aeroplane, and its constant changes of altitude, it would be an exceedingly difficult mark to hit, and rapidly to judge distance on, in order to calculate for, and adjust the fuse, to burst the shell at the right place.

We must realize accordingly, that the bomb dropped from an aeroplane or dirigible has presumably to travel some 3,000 feet, say 1,000 yards, before reaching the object aimed at; that the aircraft is going at a considerable speed, and that the projectile consequently does not drop vertically on to the target, but describes a curve, the shape of which depends on the speed of the machine at the moment the bomb leaves it; that the projectile must therefore be released some time before the machine is vertically above the target, and that bomb-dropping, instead of being a simple matter, requires skill and considerable practice.

Besides this, some special form of sighting and dropping apparatus is advisable, and the bomb-thrower must give his whole attention to his work. If he is to achieve accuracy and economize ammunition he cannot act as pilot in addition. Even so he will find that, except in such cases as strewing hand grenades broadcast over a fairly large area, such as a camp, it is exceedingly difficulty to hit the objective and get satisfactory results. So thoroughly is this difficulty realized by those who have gone into the matter by the light of the little actual experience available, that it is considered, that in order to do any serious damage at the ground level from a reasonable height, there must be a number of flying machines in action and a plentiful supply of bombs.

The Difficulty of Aiming.

Viewed from this stand point the typical 'aerial destroyer" of fiction, setting out alone, but balefully efficient, to wreck ships and forts, strew death broadcast among troops, and decimate the population of a hostile township, and then bringing the recalcitrant enemy to his knees by the threat of continued destruction on the same lines, fades into the limbo of the extravagant and the impossible, but very serious possibilities still remain to be reckoned with, and it is worth our while to go into the question of sighting for the drop of a bomb and the means of release at the right moment.

The ideal method of attack would be to approach the vicinity of the target at high speed and slow down when within range, then hover immediately over it, sight the object through a telescope, drop one or any required number of projectiles through a special tube in connection with the sighting apparatus—and return to safety as quickly as possible. Such a plan as this might be feasible at night, in calm weather, with a dirigible, which can stop its engines and float noiselessly.

It is even remotely possible that it may be achieved with a heavier-than-air machine at some future time; for if we may

(Continued on page 229.)

The Flying Boat and Its Possibilities

How Safe Flying Over Water Has Been Attained and What It Means

By Carl Dienstbach

THE latest flying machine is an aeroplane that floats and runs on water, and that, at the will of the pilot, rises into the air and comes down to water again. This invention has opened new possibilities in flying because the hydro-aeroplane can stop and end its flight wherever a motorboat can be operated, and because it can be used as easily and as extensively as a motorboat. An aeroplane derives no support from the air unless it is quickly driven ahead. It must always start and land dead against the wind, and it needs, therefore, a clear level field of sufficient extent to begin or end its flight. Moreover, it can start and land only on a specially selected flying field. The great skill required to keep the aeroplane continuously in the air makes prolonged flying possible only for very experienced pilots. Even then a landing can be safely made only on a flying field. Pilots who fly at great altitudes across country always feel worried lest motor trouble should compel a landing. Even when gliding down from a height a suitable clear level field cannot always be reached. What appears as an inviting meadow from a distance may prove to be a swamp. Against his will the aviator may be compelled to alight at great risk. In great cross-country aeroplane races machines are often broken and passengers injured when they are thus forced to come down on unsuitable ground. The hydro-aeroplane that can alight on the water can come down everywhere and at any moment with perfect safety.

Early Attempts at Flying Over Water.

There are, in fact, so many advantages to be derived by starting and landing on water, that one wonders why the aeroplane was not originally a hydro-aeroplane. The first experimenters did indeed design their machine to start and alight on the water. Octave Chanute, who was the first engineer that had a clear conception of the difficulties of flying, urged all experimenters to try their apparatus over water, because "The worst that could happen to them there would be a ducking." Prof. Langley followed the same theory. Mr. Manley, who was on Langley's machine when twice it fell into the water, after being broken by the mechanical launching apparatus, undoubtedly owes his life to Langley's foresight. Maxim ran his purely experimental machine, with which he did not attempt any free flying, on a railroad track. Hargrave, Kress and Blériot made their early free flights with motor-driven aeroplanes provided with floats and started from water. The only exceptions were Lilienthal and Herring, neither of whom built aeroplanes in the modern sense, but rather wings which were so light that the aviator could carry them on his body. Archdeacon in Paris also mounted his aeroplane on floats and started it from the water, but his was only a gliding machine without motor or propeller, flown like a kite by towing it with a fast racing motorboat. Apart from all other considerations, the most elementary engineering principles would lead an experimenter to design an aeroplane as a hydro-aeroplane. A machine which has to move ahead before it can be supported in the air is, above all things, a vehicle with horizontal sails.

It was, in fact, a very definite necessity which finally caused Hargrave, Kress and Blériot to abandon the floating planes and to give us the swift aeroplane starting from a monorail with the aid of a catapult and landing on skids on soft ground. The necessity was most clearly illustrated when Glen H. Curtiss, the inventor of the first successful hydro-aeroplane, made his first experiments with an aeroplane mounted on water floats. Curtiss had every inducement to experiment with hydro-aeroplanes, and it is no doubt due to these that the world owes the invention of his useful type. The flying grounds at Hammondsport, where the Curtiss aeroplanes are built and tested, are small, but Hammondsport is situated on the shores of Lake Keuka, which would have offered an ideal flying field if it had been possible to start the machine from its surface. Consequently, in the fall of 1908, "June Bug," the first publicly demonstrated successful American aeroplane, was taken from its wheeled chassis and mounted on two canoe-like floats that resembled an ordinary catamaran. Although this was a machine that had flown well over land and that was far better equipped to get into the air than either the Hargrave, the Kress or the Blériot machine, it could be made to run quite fast on the water, but never fast enough to rise into the air. The reason is not far to seek. A speed that may be very fast for a water craft may be too low to start an aeroplane and support it in the air.

How a Flying Boat Should be Built.

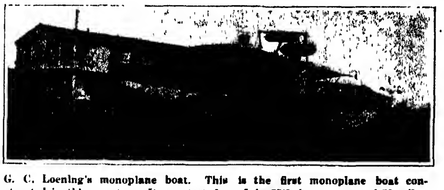
It is very easy to design a hydro-aeroplane on wrong principles. There are two ascending scales of effort that may be made to meet—then the hydro-aeroplane is successful—or which may not happen to meet each other—and then it is a failure, however well it may fly from the ground. The first scale is the constantly increasing head resistance of the floats in the water, which increases very rapidly with speed, and the second scale is the constantly increasing support of the planes in the air which also increases with the speed, but very much more slowly than the water resistance. This is due to the fact that what is fast in the water may be slow in the air, and that water resistance and air support both increase with the square of the speed. It is evident that the motor may exert its utmost power to drive a machine through the water with a speed that seems very fast, but that falls a trifle short of sufficiently supporting planes whose lifting power increases with the small squares 4, 9, 16, 25, 36, while the water resistance increases with the large squares such as 64, 81, 100, in spite of the fact that any appreciable lift would take the float partly out of the water and decrease the water resistance in turn. The result is that even a slight reduction of the resistance in water would enable a hydro-aeroplane to fly, which at a speed only a little lower, has practically no lift whatever. Obviously either a more powerful motor must be employed or the water resistance of the floats must be reduced. The four-cylinder motor that drove the first Curtiss aeroplane overland probably could not lift the present Curtiss hydro-aeroplane out of the water.

But the real solution of the problem—the real invention—lay in the design of the floats. This problem had already been partly solved in the hull of the fast racing motor-boats. Naturally, they were taken as models. A new principle was introduced, and that was the principle of the hydroplane, or gliding boat.

The Hydroplane Principle Offers a Solution.

The floats themselves had to be made to exert a lifting effort; the speed was increased to raise the floats out of the water by their own action. Thus the wings were enabled to exert their own lifting effect. In short, the hydroplane filled the gap between the two scales of effort mentioned. The moment Curtiss had found the proper shape for his flat-bottomed, rectangular-outlined float, the first practical hydro-aeroplane rose from the water.

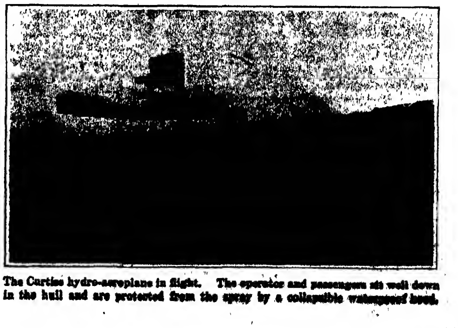
Curtiss, indeed, was not the first one to make a hydro-aeroplane rise at all. Fabre in France had anticipated him in that, but Curtiss gave us the first comparatively perfect machine. With the practical sense he has repeatedly shown, he recognized that one float has less water resistance for the same floating power than two floats, and that one float also makes the lateral balance of the floating machine more independent from the disturbance of the water level by waves than catamaran floats. He prevents his machine from capsizing by small auxiliary floats beneath the wings. He also has so shaped the floats that if by any reason or mistake of the pilot the machine should ever come down at a steep angle, the upper surface of



G. C. Loening's monoplane boat. This is the first monoplane boat constructed in this country. It was tested on July 25th in a voyage of 52 miles, during which occasional short flights were made.

The Curtiss boat is driven by an 80 horse-power motor. It is 26 feet long, 3 feet wide, and has a depth of hull about equal to the width. The planes are 5½ feet deep and 30 feet wide.

Lieut. Conneau's hydro-aeroplane in which he made some remarkable flights in France before he came to grief.



The Curtiss hydro-aeroplane in flight. The operator and passengers sit well down in the hull and are protected from the spray by a collapsible waterproof hood.

the float will not strike the water and thus overturn the machine by the tremendous resistance it would meet at its great speed.

There are at present very many types of hydro-aeroplanes. After the floats had been changed to hydroplanes nearly every type of aeroplane was transformed into a hydro-aeroplane simply by mounting it catamaran-like on two hydroplane floats that took the place of the ordinary wheeled running gear. But all these machines experience trouble if the water is rough. The single float type, on the other hand, leaps from wave to wave and starts at a light swell even in troubled water. Attempts are being made to make the hydro-aeroplane still more like a legitimate water craft by transforming it into a boat with wings. If that is done without impairing its flying qualities, it will certainly be for the better.

Even the best fliers have recently met with so many accidents while flying overland at great altitudes that ordinary men are afraid to take chances. Besides, there was always the necessity of starting from a distant flying field. As explained in the beginning, the hydro-aeroplane is not restricted to any flying field. Its shed may be erected on the grounds of any yacht club or preferably on a float anchored in the river. The shed may be floorless and the machine float like a boat on the water inside, sheltered from the wind. With its great speed and perfect obedience to rudders in the water, the hydro-aeroplane may run a long distance to a spot where the water is clear of traffic. It is not too big for a river; whereas the regular aeroplane is much too big for an ordinary road. It may run wherever a yacht runs, and withal the pilot has the pleasure of flying and of moving at high speed.

High Flying Not Essential.

Most important of all, the hydro-aeroplane, unlike the land machine, need not fly very high. It is only necessary to remember how even land birds skim the water. Flying is so much easier over water than over land because the conditions of the air over water are so totally different. Over water there is no dust, no obstacles to break up the air currents, no descending currents or air holes, and no ascending currents. The whole surface of the water is uniform in temperature. It does not heat the air and send it up in an invisible, dangerous whirlpool. In short, it may be said that near the water's surface the air is nearly as perfect for flying as over the land at great altitudes.

The whole surface of the water is one immense flying field, so that the hydro-aeroplane's pilot may come down and continue at a fast clip on the water and go up again whenever he pleases. Hence, even more or less inexperienced fliers, who have only learned to jump a few feet from the ground, may still take long excursions in a hydro-aeroplane. Too much, however, must not be expected from present hydro-aeroplanes. Obviously the floats of a hydro-aeroplane must be more like coasters than even the skids of an aeroplane. Skids are used only for a short run, but floats are required for long excursions.

Everybody knows that there is much wind over water. The planes must be pointed differently into the wind while running on the water than the floats are pointed in the water. This is something for designers to consider. The planes should be as adjustable as the sails of a yacht. But if a hydro-aeroplane is designed always to head automatically into the relative wind, like a weathervane, it will have no more to fear from squalls and storms than a motor-boat. It should also be built so strong that it will not be broken by a fall into the water from a moderate altitude, and its weight should be so distributed that in the water it will always regain an even keel and right itself again, no matter in what position it drops. If that is attained and the construction is strong, the hydro-aeroplane will be as safe as a dirigible (which it resembles because of its power of flotation). It may be upset, but it will always right itself again automatically upon touching the water and get into position to continue its flight.

The Coming French Maneuvers

THE coming maneuvers of the French army will see the application of the new ideas regarding aeroplanes and airships which were decided upon by the War Department. Each of the opponents in the maneuvers will be provided with an airship as well as a certain number of aeroplanes, and two airships will be held in reserve. To each party are allotted four fleets of aeroplanes or units of six aeroplanes each, making 24 in all, or 48 for the entire army. Each fleet is commanded by its officer. Aside from this there will be a number of aeroplanes put in service for artillery observations. On the whole, this year's programme is much more extensive than last year's, and the aeroplanes will be better organized as to supplies and repairs. For the first time there will be made an experiment in the use of aeroplanes for searching for wounded upon the battlefield, and Dr. Reymond, who is among the prominent military pilots, is in charge of this work.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Nitrocellulose and Wood

To the Editor of the SCIENTIFIC AMERICAN:

Under date of August 17th, 1912, you published an article that contained the statement that nitrocellulose solutions used as a varnish did not adhere well to wood. I have had ten years' experience in the use of materials used as varnish, and I know of nothing in this line that will adhere better.

About twenty years ago Mr. Goldsmith of the American Lead Pencil Company patented the idea of using nitrocellulose solution for finishing pencils. The idea was of great value, and Mr. Goldsmith successfully defended his patent, which is now expired.

Many hundreds of barrels of nitrocellulose solutions are annually manufactured and sold for use on wood by the concern which I represent. I am not seeking any free advertising, and my statements are merely in the interests of accurate information. There are many users of nitrocellulose solutions who well know that the statement that it will not adhere well to wood is inaccurate.

FRANK P. DAVIS.

New York city.

Futility of Dredging the Mississippi River

Editor of the SCIENTIFIC AMERICAN:

In your issue July 13th, p. 23, reference is made to the prospective use of the Panama canal plant upon the levee system of the Mississippi River "This would at once serve the double purpose of increasing the *flood capacity* of the river," etc.

Presuming that the flood capacity increase means the deepening of the river-bed and not the elevating of the height of the crown of the levees, I would state that in St. Paul, several years ago, a sand embankment was made from sand dredged from the river-bed of the Mississippi. How many hundreds of thousands of cubic yards were removed from the river-bed and piled upon the banks I do not know; but if I am correctly informed, the river bottom where the dredge sucked out the sand, like the muchly cursed Raven in Ingoldsby, "was not one penny the worse," as far as increasing its depth was concerned, and yet enough sand certainly was taken out to float the Mauretania in the displacement, and some other ships in addition.

Prof. Pinchot estimated that each year 400,000,000 tons of surface abrasion, call it silt, finds its way into the river, which, as it drifts along, helps to fill up a pot hole or two here and there.

Mark Twain, who knew the river quite well, and as a pilot had need to, remarked that dredging the Mississippi and keeping it dredged would be accomplished coeval with the time when Hades froze over. An indefinite proposition as to the fixedness of time and eloquently expressive of a negative result.

Point Loma, Cal. CHARLES CRISTADORO.

A Defect in Our Patent System

To the Editor of the SCIENTIFIC AMERICAN:

What seems to some a defect in the patent system appears to have been overlooked by Congressman Oldfield and other recent investigators. I say defect in the patent system, because while the defect appears in the procedure before the Patent Office, no remedy is suggested except through the change in the law itself.

I refer to the practice, that permits the issue of patent with claims dominating a prior patent without the prior patentee's having been afforded an opportunity of contesting the question of priority with the later patentee. This condition of affairs is found, when A issues a patent on limited claims, and B in an application pending concurrently with A's or filed subsequently to the issue of A's patent secures the issue of his patent with claims broader than A's. Suppose for instance, A shows one specific form of a generic invention and issues his patent on claims specific to his form. B then, after the issue of A's patent files his application for patent for a different specific form of the same generic invention and issues his patent subsequently to A's on broad claims for the generic invention by making oath to the completion of his invention prior to the filing date of A's application. B may delay the issue of his patent so long as to defeat A's right to a reissue or A may in other ways fail of reissue rights. How shall it be remedied? Possibly by providing special reissue privilege to A under the circumstances and by requiring, on the allowance of broad claims to B, that the patentee A, shall be notified and given the opportunity of filing reissue application containing the broad claims. Such notice might secure one of two results. In the first place, the patentee might assert a claim to the invention and file proper papers toward the enforcement of his claim. On the other hand, he might be in possession of some facts, which would show that the invention covered in the claims suggested and allowed to the subsequent applicant were not patentable, and in this way, the action might not only result in preventing an injury to a patentee, but, might also be of service to the public in preventing the issue of a patent for claims which were not, in fact, patentable.

Possibly some better remedy can be suggested. I do not feel capable of suggesting the full remedy, but only call attention to something that seems to demand remedial action. AN INTERESTED READER.

[In the case referred to, it appears that each inventor got what he claimed. Presumably each claimed what he invented, and so got all that he deserved.—EDITOR.]

Some Obstacles in the Way of Converting the Sahara Desert into a Sea

To the Editor of the SCIENTIFIC AMERICAN:

The idea of flooding 250,000 square miles of Sahara through a canal from the Mediterranean has some interesting features. You say that this area has 6,969,600,000,000 square feet. There are 525,600 minutes in a year. To put one foot of water over this surface in a year would require the canal to carry a little over 13,200,000 cubic feet of water per minute. As the evaporation in Sahara would probably not be less than five feet per annum the canal would have to carry 66,000,000 feet per minute to provide for this evaporation. A canal having a body of water 100 feet wide and 25 feet deep would provide for this if the flow was five miles per hour, but five miles per hour for an average would make a very swift stream in the center. Hence, the canal would have to be about three times as wide to prevent the banks from being washed away.

So far we have only provided for evaporation. To fill the 250,000 square miles to a depth of 200 feet in forty years would require a canal of twice the size or about 600 feet wide. If it were to be filled in less time it would be necessary to have the canal still larger. Of course the whole 250,000 square miles would not be covered at once, and consequently the evaporation would not be so great for several years, but the sands of Sahara are probably pretty thirsty and would probably absorb a good deal of water before any surface of consequence could be had.

But there is another view of the matter that is interesting. If the surface of Sahara is 200 feet below the ocean, then the lower parts of it might be filled to the depth of 100 feet and the remaining 100 feet be used as a fall to obtain water power. Assuming that 100,000 square miles would be covered in this way the canal would be required to carry 5,280,000 cubic feet of water per minute to balance evaporation. This quantity of water falling 100 feet would give approximately 1,000,000 horse-power. Assuming 50 per cent efficiency, 500,000 horse-power might be useful when sent over wires at about 100,000 volts. An inland sea of 100,000 square miles would probably be sufficient for ordinary purposes. But is the Sahara Desert as low as this, and is it possible to get any such thing?

Chicago, Ill. C. L. REDFIELD.

A Mathematical Card Trick

To the Editor of SCIENTIFIC AMERICAN:

The following is an old and interesting mathematical card trick, and perhaps some of your readers can explain why it works out.

From a pack of playing cards take out the jacks, queens and kings, leaving thus 40 cards. Now lay them face upward in the following order:

(Diamonds)	1	2	3	4	5	6	7	8	9	10
(Hearts)	10	1	2	3	4	5	6	7	8	9
(Spades)	9	10	1	2	3	4	5	6	7	8
(Clubs)	8	9	10	1	2	3	4	5	6	7

Next pick up the cards, one at a time, and lay them in a pile face downward, beginning from the right upper corner (10 of diamonds) downward to the 7 of clubs; follow with the next line to the left (9 of diamonds, 8 of hearts, etc.) and so on to the last card at the left lower corner (8 of clubs). Now spread the cards again, face downward, in 4 rows of 10 cards each, from left to right beginning with the card at the top of the pack (8 of clubs). The cards are now ready for performing the trick which consists in guessing the exact location of any of the cards, at the request of the spectators.

To work it out multiply the number representing the value of the card called for by 4 and add 3 for hearts, 6 for spades and 9 for clubs (nothing for diamonds). For instance, suppose the 2 of diamonds is called; 2×4 equal 8. The eighth card (counting from left to right, first upper row) is the 2 of diamonds. The 6 of hearts would be found thus: 6×4 equal 24, plus 3 equal 27; the 27th card, i. e., the 7th card in the third row should be the 6 of hearts, and so on. When the product plus the number added exceeds 40, count the excess from the first upper row again; for instance, the 9 of clubs should be 9×4 equal 36, plus 9 equal 45 (excess 5) the 5th card in the first row is the right card.

Mayaguez, Porto Rico. WILLIAM FALBE.

The Gnome Rotary Engine

The Airman's Chief Reliance

By Earle L. Ovington, Consulting Engineer, Licensed Aviator

Wonderful records for speed and endurance, for high-flying and passenger-carrying have been made. They testify mutely to the efficient motors upon which the record-breakers relied. Almost all of the more remarkable feats of the aeroplane have been achieved with the rotary motor—a type originally invented in this country but carried to perfection in France. In this article, written by a man who is not merely a noted pilot but also an engineer trained at the Massachusetts Institute of Technology, we are told what the Gnome engine means to the man in the air and to what its astonishing success is due.—EDITOR.

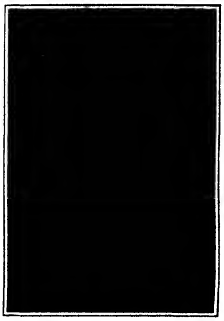


Fig. 1.—The cylinder blanks as they come from the drop-forging hammers.

Fig. 2.—First process of working the heavy cylinder blank—roughing out the bore.

Fig. 3.—Flanging a cylinder in seven and one-half minutes; the previous tool took nearly three hours.

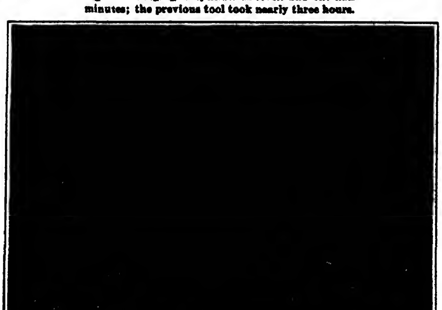


Fig. 4.—The process of finishing the cylinder head requires frequent regrindings.

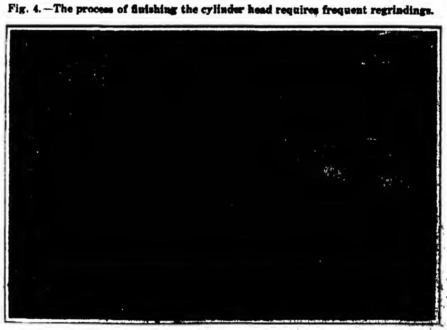


Fig. 5.—Grinding process in finishing, where a mirror-like surface is obtained in the bore of a cylinder.

ONE of the most interesting afternoons, if not the most interesting, that I spent in Paris was when I went through the well-equipped factory where the wonderful rotary Gnome engine is made Monsieur Seguin himself, the designer of the motor, acted as my guide so you may be sure that I saw about everything there was to be seen.

The spectacularly rapid development of the aeroplane is due, far more than even those in close touch with aeronautic affairs seem to appreciate, not so much to the improvement of the aeroplane itself as to the perfection of the motive power

In July, 1909, Blériot flew the English Channel, and his feat was heralded as almost miraculous. And, indeed, it was, as those can appreciate who are acquainted with the motor he employed for his epoch-making flight—a three-cylinder affair, which developed not over twenty-five horse-power at the most. I learned to fly at Pau, France, with the same type of motor and was forced to try three before I could get one which would remain cool long enough to carry me the short distance required in the flights for a pilot's license. And when I landed, the temperature of my engine was nearer that of an overheated stove than that of an efficient internal combustion motor The Blériot monoplane of to-day is practically the same as the one used in that memorable first Channel flight, and yet is capable of sustained operation across country as well as ideal for high-altitude work. In fact, the world's altitude record, made by Garros, was made with this machine. In the Boston *Globe's* Tri-state aeroplane race, I won the $10,000 prize by flying one hundred and eighty-six miles in three hours and six minutes, and when I landed my motor was in nearly as good condition as when I started

Why this difference between the monoplane with which Blériot was just able to fly the Channel, and the modern efficient plane of to-day? One word tells the story —the motor To be sure, aviators are more daring in 1912 than they were in 1909, but primarily, this is due to the fact that they know their mechanical birds are more dependable than formerly; and this dependability is largely due to the improvement in the motive power

If I were asked to give my opinion of the Gnome motor in as few words as possible, I should say that it was theoretically one of the worst designed motors imaginable, and practically the most reliable aeroplane engine I know of I should have to add as a qualification that I assume it receives the constant attention of expert mechanics. As I had two seventy horse-power, seven-cylinder Gnomes with my Blériot monoplane, and probably flew more miles last season with a Gnome motor than any other aviator in America, I speak from experience. If an expert engineer on gasoline engines were asked to examine a Gnome motor, one having no previous knowledge whatever of the mechanism, he would unquestionably pronounce it an impractical, though a highly ingenious construction. In fact, when the first Gnome shot meteorically into the limelight, this was the universal opinion in engineering circles.

You can hold a Gnome piston in one hand and break a piece from it with the thumb and finger of the other, the walls are so fragile. The valves are so thin and so large that you never cease to wonder why they are not warped out of shape before they have been in service three minutes. Literally, no piston rings are used, the "obturateurs" which serve the purpose being simply rings of thin sheet bronze, one to each cylinder. Compression in a Gnome is noticeable by its absence and, "of course," says the engineer upon first examining the engine, "the spark plugs would be rendered useless as soon as the motor attained its speed." This is what might be expected with the plugs situated in the cylinder heads of a revolving motor where a gallon of oil goes past them every hour of operation, but there is seldom plug trouble. Yet, withal, the Gnome motor is, in my opinion, in a class by itself where the greatest power for the least weight, together with reliability, is desired.

The Gnome is a very expensive motor to buy and to keep up. My seventy horse-power engines cost me $4,000 each, and I paid three French mechanics fancy salaries to act as trained nurses for the delicate mechanisms. *But I had the highest power motors for their weight, and that is what is wanted for exhibition work.* At the Chicago meet, I won the price of a motor in a couple of days' flying. Yes, I will acknowledge the Gnome is expensive to buy, expensive in upkeep and delicate in construction, but for speed and reliability, I have not found its equal.

"How can a delicate motor be reliable?" you say, and I do not blame you for asking, for such a statement seems paradoxical. Nevertheless, it is a fact. Let me explain. Usually every fifteen hours of running, and at most every twenty, my mechanics went through the interesting process of separating every single component part of my motor one from the other. The valves were reground and retimed, new valve springs were inserted, the tappet rods were adjusted, and the whole motor was given a rigid inspection. The Gnome, in common with most rotary motors, uses castor oil as a lubricant, hence at each cleaning great quantities of carbon were removed. I claim that any engine requiring such attention may rightly be termed "delicate." How far would you get in an automobile if you had to take the entire engine to pieces and readjust practically every working part of the whole motor every fifteen or twenty hours of service?

But—and this is the important part to the aviator who depends upon speed and

Fig. 7.—A pile of completed cylinders cut from solid bars of steel at the Gnome factory.

Fig. 8.—View picturing the finishing of the hollow crankshaft of a Gnome motor.

exhibition work for his remuneration—my Gnome motors never stopped while I was in the air, unless I purposely cut off the ignition, and—another consideration of equal importance—I had great power combined with light weight, which usually brought me in either the winner, or at least second man, in a race where perhaps the prize was $1,000 for a fifteen-minute flight. I made one hundred and seven flights in my Blériot and never broke a single stick in the machine, and I attribute my success largely to the fact that my motor never failed me in the air. I had several bad smashes, but in every case without exception these smashes were due to motor trouble, and they occurred when I flew a machine other than my faithful Blériot "Dragon Fly," which was given such careful scrutiny by my expert French mechanics.

The Gnome factory, situated on the outskirts of Paris, is not a large one, but it is unusually well-equipped and up-to-the-minute in operation. The very latest type of machinery is employed throughout, and wherever possible it is automatic to the last degree. This employment of automatic machinery of the latest pattern is not as common in France as in this country, and even in some European countries, for the French are proud of their handwork. Incidentally, the greater part of the automatic equipment is made in America—the home of the automatic machine tools. If we judge the character of a factory by the weight of its output, then we would have to acknowledge that the Gnome establishment turns out steel shavings, with motors as a by-product, since for every pound of motor manufactured, there are over ten pounds of shavings. There is not a single cast piece in the Gnome engine—every part is cut from a drop forging or from the solid metal. Fig. 1 gives an idea of the cylinder blanks as they come from the drop forging hammers. Each blank weighs in the rough no less than eighty-one pounds. This weight is reduced to four and one half pounds to make a cylinder for the lightest motor in existence, for its power Fig 2 shows the first process of working the heavy cylinder blank—roughing out the bore. Fig 3 depicts what was to me the most interesting process of all—that of flanging the cylinders. Thirteen cutters, working simultaneously, produce the most highly finished and most perfectly formed flanges I ever saw on a gasoline engine. You cannot look at the Gnome motor, and be interested in engine design at all, without being lost in admiration of the beautiful machine work as exemplified in the flange construction of the cylinders This flanging tool, Monsieur Seguin explained to me, takes just seven and one half minutes to complete its work on a cylinder, while its predecessor required almost three hours for the same job. "And," he added with a twinkle in his eye, "we had to go to Berlin for it—you Americans have nothing so rapid in operation." I replied that I noticed that most of his machine tools bore the name plates of American manufacturers, which indicated that if we could not make cylinders as rapidly as the Germans, we excelled in almost everything else. Fig. 4 illustrates the finishing process of the cylinder head The exhaust valve screws into the end of the cylinder and may be removed, complete with its seat, for the frequent regrinding necessary to efficient operation In Fig 5 the grinding process is shown After the cylinders are ground with the greatest care and accuracy, the finishing is carried still further by wearing-in the cylinder with an actual piston carrying an "obturateur" No pains are spared to obtain the mirror-like surface so noticeable when one examines the bore of a Gnome cylinder

Fig. 6.—Workmanlike job of welding the bushing into the side of the cylinder head by autogenous process.

The bushing into which the spark plug screws is not integral with the cylinder as in a cast construction, but is welded into the side of the cylinder head by means of the autogenous process as shown in Fig. 6 An unusually workmanlike job is the result A pile of completed cylinders is shown in Fig. 7. This engraving indicates plainly the enormous size of the hole in the cylinder head into which the complete exhaust valve is screwed. It is also evident that this construction enables the inlet valves to be easily removed, since these screw into the piston head. Both inlet and exhaust

(Concluded on page 230.)

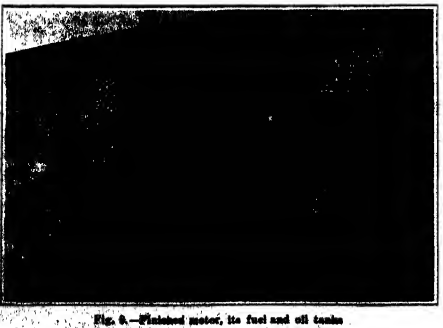


Fig. 9.—Finished motor, its fuel and oil tanks mounted for testing on a sort of gun carriage.

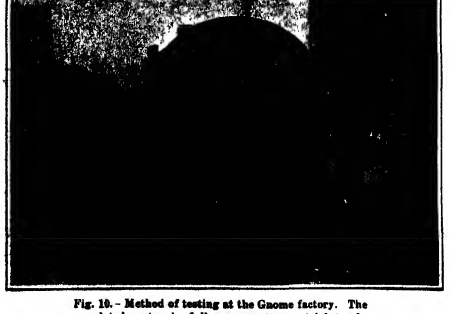


Fig. 10.—Method of testing at the Gnome factory. The completed motor in full movement on a trial truck.

Studying the Flying Machine in the Laboratory

Recent Progress in Experimental Aerodynamics

By A. F. Zahm, Ph.D.

As sundry detailed and unrelated accounts of modern aerodynamic laboratories have from time to time in current literature disclosed the equipment and manifold activity of these institutions, it seems advisable to have a general review of the aggregate recent development in the basic science of aerial locomotion; a review primarily of the physical results achieved, and secondarily, of the appliances and methods of investigation. No more competent scientist can be found in this country to write such a review than Dr. Zahm. He has conducted original studies which have done much to clear up some of the obscurer phases of the subject of aerodynamics, and what is more, has kept alive interest in aerodynamics by contributing admirably written and illuminating articles to the SCIENTIFIC AMERICAN *and other periodicals.*—EDITOR.

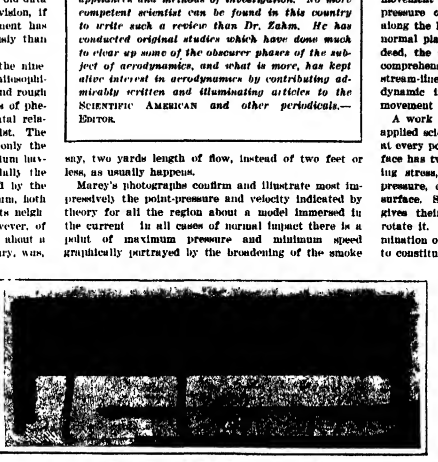
BROADLY stated, the men of the nineteenth century outlined the essential features of dynamic aerial transportation, and demonstrated its feasibility, but left to the twentieth century the arduous labor of establishing its commercial practicability. The pioneer efforts in this science comprise a long succession of valuable researches, made sometimes with simple models and sometimes with complex structures equipped for actual flight. The early methods of experiment and computation still obtain; but the old data and, in part, the old designs have needed revision, if not radical alteration. This work of refinement has occupied recent investigators no less laboriously than the making of new discoveries.

The developments of aerodynamics during the nineteenth century are of practical rather than philosophical interest. They furnish approximate laws and rough data for the engineer rather than explanations of phenomena through those intimate and fundamental relations so important to the mathematical physicist. The science of fluid dynamics must disclose not only the resultant effect on a body immersed in a medium having relative motion with it, but more especially the proximate cause of such effect, as determined by the velocity and stress at each point of the medium, both at the bounding surface of the body and in its neighborhood. The experimental investigation, however, of the velocity and stress of the air at all points about a model, though initiated in the nineteenth century, was, for thorough prosecution, left over to the succeeding one.

And now the ancient practice of moving the model through the air, so popular with Newton, Robins and the long line of pioneers down to the culmination of the researches of Lilienthal and Langley, was largely superseded by the practice, introduced by Phillips and Maxim, of holding the model fixed in a uniform air-stream where it can be studied by stationary instruments. The uniform current is commonly produced by drawing air through a large tube or wind-tunnel by means of a suction fan drivable at various speeds from five to fifty or more miles per hour. The usual method of eliminating swirls and irregularities of speed is to pass the air through a sheet metal "honeycomb" at the front end, and to keep the suction fan running at constant speed. In shape, the tunnel may very well be a cylinder determinated by stream-line cones, the whole raised well above the floor. If the cones be so formed as to eliminate eddies, they obviously also enhance the economy of the circulation. Assuming, therefore, a uniform current available, we may consider the means and results of various determinations of the velocity and stress in the medium, both at the surface of immersed models and at various distances away.

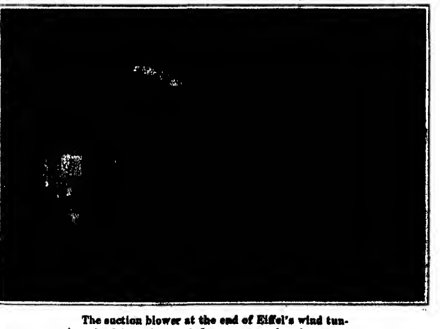
The very ingenious method of mapping at all points of an air-stream the complete velocity of the fluid, that is its instantaneous speed and direction, by intermittent photographs of floating particles, was introduced by Prof. Marey. From the hollow teeth of a comb held squarely across the current, smoke streams one fourth inch in diameter and of a like distance apart were emitted in continuous flow extending through all the region about the model to be studied. These numerous streams showed the direction of flow in all places except where they were broken into eddies and promiscuously intermingled. They also indicated approximately the speed of flow, being crowded together where the current was swifter and expanded where it was slower. In special cases the speed was still better portrayed by causing the comb to vibrate ten times per second transversely to the current, thus giving each small stream a wavy flow whose speed everywhere was indicated by the number of waves per unit of length. The method is most instructive and would be much enhanced in value if the streams could be made to remain clearly defined and separate for, say, two yards length of flow, instead of two feet or less, as usually happens.

Marey's photographs confirm and illustrate most impressively the point-pressure and velocity indicated by theory for all the region about a model immersed in the current. In all cases of normal impact there is a point of maximum pressure and minimum speed graphically portrayed by the broadening of the smoke streams. About the sides of a model are regions where the stream lines crowd together, manifesting increased speed and lessened pressure. At the rear of the model, if of easy shape, the lines broaden again, showing increased pressure and slower speed; while if the model be of blunt form, the smoke streams portray a confused and tumultuous wake. When the stream passes by an inclined plane or arched surface, it may deviate so violently as to exhibit an elastic and undulatory movement about the model, an undulatory wake, and a pressure of pulsating intensity from point to point along the line of flow. A like effect is observed about normal planes and solid surfaces of bluff outline. Indeed, the manifestations of Marey's diagrams are so comprehensive and picturesque as to suggest that stream-line photographs should be taken in all aerodynamic investigations where the character of the movement of the fluid is not perfectly well known.



The pressure-tube anemometer of Dr. Zahm.

Marey's photographs of the air streams under varying conditions.



The suction blower at the end of Eiffel's wind tunnel, driven by a 50 horse-power electric motor.

A work of equal or greater importance, at least for applied science, is the determination of the fluid stress at every point. The point stress on any element of surface has two components; one called friction, or shearing stress, parallel to the surface, the other called pressure, or normal stress, and perpendicular to the surface. Summing these point forces all over the model gives their resultant effect tending to translate or rotate it. So important, indeed, is the separate determination of these elements of force that it may be said to constitute, along with the delineation of the stream-line velocity, the characteristic merit of twentieth century investigations in experimental aerodynamics.

As yet no adequate instrument for disclosing directly the point friction at each part of the fluid stream, whether in its depth or where it glides along the model's surface, has been employed, if indeed so much as devised or suggested. Still the friction of air, flowing smoothly at low speeds, has been determined indirectly by many physicists, and the surface friction at fairly high speeds has been found by a few students of aerodynamics. The present writer in 1902-03, by suspending a thin board edgewise in a uniform stream of air, determined the friction on the surface of various materials, in a manner resembling that of Froude's experiments in water; Francke in 1907 obtained like results by allowing thin blades to swing edgewise through the air suspended from a heavy pendulum sharpened to offer slight resistance; and Fuhrmann found the friction on torpedo-shaped models suspended in a wind tunnel, by subtracting from their total resistance the resultant pressure obtained by the manometric method presently to be considered.

The point-friction of air flowing in uniform and unconstrained current along thin smooth boards two feet wide and of various lengths and coatings was found in my experiments to diminish as the power —0.07 of the length of surface, and to increase as the power 1.85 of the speed. The magnitude of the friction was practically the same for all coatings of the board, whether glossy, dead or sticky, provided they were not rough or uneven. For rough surfaces, such as that of coarse buckram, the friction varied as the square of the current speed. On smooth two-edge posts of least resistance the resultant pressure and friction were about equal. They were also of like magnitude on hull-forms of least resistance, and on inclined planes meeting the current at an angle of a little over two degrees. The actual friction per square foot on any rectangular plane surface four feet long, in a wind blowing uniformly at ten feet per second, is 0.00050 pound, and for any other speed and length of surface can be calculated by application of the foregoing relations. A table so computed for a great variety of speeds and lengths of surface was published by the Philosophical Society of Washington in June, 1903.

The pressure intensity should be explored both in the interior of the current and where it flows along the surface of a

...erged model. For the first region no very effective ...ment has been developed, though Drs. Finzi and ...ti invented a device which approximately gives ...the velocity and pressure at any point in the cur... away from the model. The point pressure over ...model's surface is very easily measured by trans...ion through a hole in the surface, thence to a ...ciently delicate pressure gage. The writer devised ...his wind tunnel experiments ten years ago a pres... gage graduated to millionths of an atmosphere, ... usually read to one ten-millionth.[1] This was ap... to studying the pressure distribution over solid ...ces immersed in the wind current. Many experi...alists use as a pressure gage an inclined glass ... having a column of colored alcohol and graduated to millimeters of water, or approximately to one ten thousandth of an atmosphere, and usually read to fractional parts of a graduation. As a rule, of course, only the difference of pressure between the unchecked part of the current and each point of the disturbed part about the model has to be measured, so that the instrument need only be an accurate differential gage.

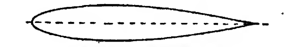
The manometric method just described has of recent years figured in a great number of important investigations. First used in the nineties, in a pioneer way, by Irminger and Vogt, by Prof. Nipher, and by Mr. Dines, it was next employed at the beginning of this century in the elaborate investigations of Drs. Finzi and Soldati of Milan, to reveal the pressure distribution over inclined plates, both arched and plane, also spheres, cylinder and spindle forms. It has been since used in the careful and accurate measurements of Stanton in England, Prandtl in Germany, and Eiffel in Paris, not to mention various others. The resultant pressure so obtained for normal impact was found to agree satisfactorily with that given by an aerodynamic balance in which the wind force on the model was measured directly by equilibration against a known force, usually a weight or spring tension.

The results of numerous experiments on normal impact, made in these various laboratories, exhibit a general uniformity of characteristic features. Calling ρ the density, v the velocity of the air, all the measurements disclose a maximum pressure equal to $\rho v^2/2$ at the front center of the exposed plate, a more and more rapidly waning pressure toward the front edges, and a practically uniform pressure over the back, varying indeed with the shape, but bearing for various plates no fixed relation to the front pressure. All show that in air of any given uniform speed and density the pressure intensity is practically the same at all similar points of similar plates whatever their size, beyond a square yard, and hence that the resultant pressure is substantially proportional to their area.[2] But for dissimilar shapes the mean pressure is shown to be as much as fifty or sixty per cent greater on elongated plates than on square ones of the same area. All experiments, of course, show that the resistance varies directly as the density and square of the velocity of the air. As to absolute magnitude, there is not such close concordance, but the most accurate measurements give for a foot square blade, at normal air density, a resistance not far from $0.003V^2$, in which V is the velocity in miles per hour.

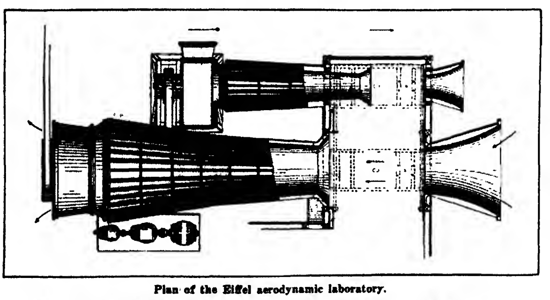
All measurements on inclined plates likewise accord in some important general disclosures. They show that oblique flat plates have sundry properties common to oblique concave ones, and also certain marked differences. Both kinds encounter more resistance when of elongated form and set long edge foremost; both manifest a varying pressure distribution on the face, and a varying suction on the back, usually of greatest intensity near the front edge; both exhibit feebler pressure and suction near their lateral edges, owing to the lateral escape of air. But flat plates have a resultant pressure whose magnitude at small angles of incidence increases directly as the angle, and whose position travels forward with increasing obliquity; while arched plates have a resultant whose magnitude varies in no simple manner with the obliquity, and whose position retreats as the small angles of incidence diminish, wherefore such forms tend to dive precipitately.[3] Flat inclined plates are less efficient carriers than arched ones; they also leave behind a tumultuous wake, entailing loss of power, while arched ones deflect the airstream smoothly and leave an unruffled, though doubtless an undulatory, wake. For this reason good arched forms require less propulsive force for a given lift, and in some excellent designs carry ten to fifteen pounds of weight per pound of thrust.

The measurements made on elements of hulls and framing of air craft have shown that these also can be so shaped as to reduce the resistance in a like degree. A stream-line hull of torpedo form can be made to meet a resistance of less than one tenth, probably less than one fifteenth, that of its major circle. The same may be said of the resistance of sharp streamline posts and rods as compared with their major sections taken squarely to the wind. The tendency in designing fast air craft is, therefore, to give streamline shapes to all exposed elements, and to encase all parts that need not be exposed, or that do not admit of sharpening. But the practice of polishing to eliminate friction seems futile, since a glossy surface has the same friction as a dead one, other things equal.

As the prescribed limits of this article have now been exceeded, nothing can be said of recent investigations on propellers, and on shapes and devices to insure the stability and steadiness of air craft. It is, however, worth remarking that the ablest designers to-day eagerly study the investigations made in the great aeronautical laboratories, and, even if they do not engage in such work, as did their predecessors up to the advent of public flying, they promptly turn it to profit, realizing that the adequate test of an aerodynamic model, besides being easy and economical, furnishes a secure basis for predicating the performance of a full-size machine.



The hull of least resistance.



Plan of the Eiffel aerodynamic laboratory.

The large and small wind tunnels are shown side by side. Their diameters at the experiment room are 2 and 1 meter, respectively.

[1] Measurement of Air Velocity and Pressure, *Physical Review*, December, 1903.

[2] For areas below a square yard the coefficient of resistance diminishes slightly with the area.

[3] As an aeroplane flies downward more steeply and swiftly its angle of incidence diminishes more and more; and if the surface be concave the center of lift on the wing moves well back, tending to steepen the dive. This fact may explain some noted cases of loss of control in downward flight.

Russian Bast and Its Uses

RUSSIAN bast is the trade name given to the fibrous inner bark of the European linden tree (*Tilia europea*). This tree abounds in the forests of Europe and finds its best development principally in the western central provinces of Russia. It is very closely related to the American linden or basswood (*Tilia americana*), and is a favorite for planting in parks and along streets, both in Europe and in this country. The European linden is remarkable for the abundance and fine quality of fiber it contains in the inner bark. Enormous quantities of this bast fiber are gathered every year and exported. In fact, it constitutes one of the most considerable by-products of the forests in central Europe.

Stripping the bark from the trees lasts from the middle of May to the middle of June. This is the period when the bark is most easily removed from the stems and branches. When the bark is whole it is employed for roofing, for the river boats, as well as for making sledges, carts, boxes, etc. When it is removed in several pieces it is used for matting and bags. The bark of the young linden trees is used for making cordage, sandals for the peasants, and for all sorts of baskets, etc. The trees must be at least three years old before they are large enough to be peeled for making shoes. To every pair of shoes from two to four young linden trees are required.

The trees from which the bark is removed are felled during the following summer or fall and the wood converted into charcoal, which is said to be of very good quality and is highly prized by the manufacturers of gunpowder. The young forests of this species are thus being rapidly destroyed in consequence of this enormous use of linden bark procured from the promising young trees. The bast of still larger trees is used for other purposes. For instance, trees from eight to sixteen years old are cut for making mats. The bark is first cut or divided longitudinally into strips from 4 to 6 feet long and then raised with an instrument made of bone, after which it is easily torn off with the hand. When the bark is removed it is stretched on the ground to dry, two or three strips being laid one over another and kept straight by being tied down to long poles.

The bast for foreign consumption is made into mats which are generally about six feet long and three feet six inches wide. These are used especially for packing large objects as machinery and furniture. Excelsior and other packing material have during more recent years been substituted for bast. Immense quantities of bast are consumed by gardeners in Europe. About twenty-five years ago the annual production of bast in Russia amounted to about 14,000,000 mats, and about one fourth of these were for export.

When the bark is to be used for cordage or for cloth it is first steeped in water for several days until the cortical layers separate from each other. The best and strongest fibers are in the layers next to the wood, and the coarsest and weakest are nearest the outside. After the fiber has been macerated it is employed in England for making stout ropes, in France for well ropes and clothes lines, and in Sweden for fishing nets, for which purpose its durability eminently fits it. Russian bast is used also for making excellent paper of remarkable smoothness. Formerly gardeners used it very extensively all over Europe and in this country as a covering or protection to glass frames. Its use for this purpose has fallen off considerably since the introduction of raffia, which has become so popular in nursery work and green houses for tying up young trees and garden vegetables. It is still used in Russia for making baskets, hampers, and prepared fiber for hats and cordage of the finest quality. Like the closely related Japanese linden tree (*Tilia cordata*) it is sometimes used for making a coarse cloth and in the manufacture of mosquito nets.

The continual destruction of the young trees through this wasteful practice of removing the bark naturally diminished the supply. The peasants in a good many regions where the trees grow still utilize the bark for numerous purposes, but other material will gradually be substituted, and the bast only of merchantable trees utilized for making superior grades of paper. The wood itself is very white, light, close grained, and is used for interior finishing, carving work, barrel heads, and in the manufacture of carriage boxes, cheap furniture, etc. Quite a demand has recently sprung up for linden wood, both in this country and in Europe, by the manufacturers of cigar boxes. This at once rendered the wood too valuable for the trees to be cut before they have attained merchantable sizes. There are many other uses for which it is especially adapted, and the value of the wood has now surpassed that of the bast.

Rolling Lead by Electricity

LEAD is now worked in the Beuthen plant in Germany by means of electric motor-driven rolls, these having been driven by steam up to a recent date. There are now two separate rolls used for producing sheet lead of various sizes. On the smaller of the two rolling mills is used an electric motor running at 345 revolutions per minute with a double gear reduction, the rolls being 10 feet in length and 18 inches diameter, and running at 5 revolutions per minute. The second set of rolls is 12 feet long and 21 inches in diameter and works at 7 revolutions per minute by means of a 60 horse-power electric motor. Worm-gear reduction is used in this case to reduce the motor speed from 345 revolutions per minute to the above. The electric motors are operated directly on a high-tension circuit of 2,000 volts and are equipped with starters placed in an oil bath. On the tests of the present rolls it was shown that when starting with a 7-ton lead plate of 6-inch thickness, working at a heat of 100 deg. Cent., the width of the plate being 6 feet, about 65 horse-power is required to roll this down to a 0.12-inch thickness. On the whole, the electric driving is considered as much the best method for this kind of plant.

The Biggest Ship

IT is easier to realize the dimensions of big constructions on land than of those afloat on the sea. The tall building, for instance, looks its size, for it stands amid other structures, with whose dimensions we are familiar and by which we can gage the stupendous proportions of the sky-scraper. But when the giant steamship is afloat upon the high seas it is seldom that there is any object in her vicinity which serves to convey to the mind an adequate sense of her great proportions.

It is for the foregoing reason that the artist has taken the liberty of upending the largest steamship in the world, and standing her side by side with the world's tallest building. The result is certainly Brobdingnagian and well calculated to impress the man on the street with a sense of the huge dimensions of length, breadth and depth, which characterize modern steamships of the largest size.

The Woolworth Building, which for the time being holds the distinction of being the tallest office building in the world, is certainly a most imposing structure. Architecturally, of course, it may be open to objections on grounds of æsthetic taste, although, in justice to the architect, we must confess that in view of the severe conditions imposed upon him we consider that he has produced a very creditable result. The Woolworth Building stands on a plot about two hundred feet square, and it rises to a sheer height of seven hundred and fifty feet above the sidewalk. Had the tower stood in the center of the mass, instead of rising from the center of the Broadway façade of the building, the total result would have been better; but it was not until after the building was started that additional land to the westward was secured—this at a time when it was too late to alter the original location of the tower.

To anyone who is not familiar with the exact dimensions of the largest ocean liners, it would seem impossible, as he gazed skyward to the finial at the top of the Woolworth Building, that any ship, if stood on an end, would reach so far into the heavens; certainly he would be staggered to learn that the big Hamburg American liner would out top the pile by no less than one hundred and fifty feet.

What is Miasma?

IN a remarkable lecture at the University of Geneva Dr. A. Trillat, of the Pasteur Institute in Paris, recently expressed the view that the old idea of "miasma" in relation to disease is in a great measure reconcilable with our present theories as to the nature of infection.

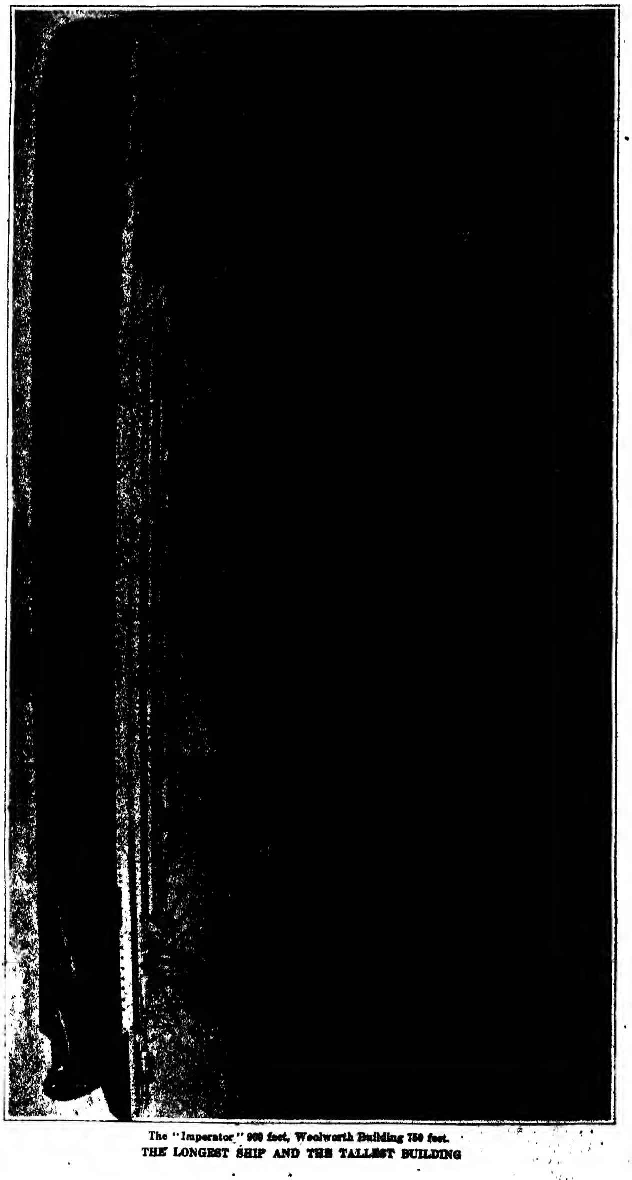
From ancient times down to the middle of the nineteenth century infectious diseases were supposed to be due to a corruption of the air, especially as resulting from putrefaction. Thus a certain epidemic at Venice was traced to an accumulation of decayed fish; one at Delft to spoiled cabbages, etc. The idea of a bad odor was inseparably connected with the vitiated air, or miasma, that spread infection; hence, the wide use of deodorants as a means of protection.

Doctors and priests, required by their professions to minister to the plague-stricken, carried perfumed torches, incense-burners, and the like; houses and towns were disinfected by burning various substances that were supposed to neutralize the poison in the air. Fires in general were supposed to be disinfectant. Hippocrates caused fires to be lighted in the streets of Athens to allay the plague. The burning of juniper berries was a favorite means of fumigation. Another was to sprinkle vinegar on hot stones, the resulting vapor being regarded as a sovereign disinfectant.

With the advent of bacteriology the idea of miasma as a cause of infectious diseases naturally fell into disrepute. Since these diseases became regarded as the work of various micro-organisms, disinfection was henceforth applied directly to the destruction of disease germs. The point that appears to have been lost sight of, according to Dr. Trillat, is that although malodorous gases are no longer looked upon as the direct cause of infection, yet they may greatly promote the process by providing a favorable medium for the development of bacteria. The lecturer described a number of experiments that he had carried out to ascertain the effects of the gaseous products of putrefaction on the vitality and fecundity of pathogenic bacteria. Without repeating the details, which will be found in the *Archives des Sciences physiques et naturelles* for June 15th, 1912, it may be stated that the development of the germs of diphtheria and plague was found to be remarkably stimulated by their exposure to air containing small traces of putrid gases. The experiments were first tried under laboratory conditions; then confirmed by exposing similar bacteria to the products of natural putrefaction out of doors, as in the neighborhood of marshes, sewers, and the like.

The upshot of these experiments appears to be that the development of pathogenic bacteria is greatly affected by the composition of the atmosphere. The subject is by no means simple; one species of bacterium may be very differently affected from another by a given gas. Nevertheless, it seems likely that many now obsolete methods of disinfection may be rehabilitated as a result of further studies in this direction.

M. Trillat is responsible for the opinion that the rapid souring of milk and putrefaction of meat during thunderstorms is similarly due to a change in the composition of the atmosphere at such times, and not at all to electrical discharges, as has often been held. According to his view, the diminution of barometric pressure accompanying storms promotes the release of putrid gases from the soil, and these gases stimulate the development of the bacteria concerned in the two processes in question.



The "Imperator" 900 feet, Woolworth Building 750 feet.
THE LONGEST SHIP AND THE TALLEST BUILDING

THE British Consul at Calais reports that a French company is seriously considering the project of a passenger aeroplane service between Calais and Dover, and has made proposals to the municipality of the latter town as to the selection of a suitable landing place.

The "Ankle-Deep" going 40.3 miles an hour.

The Race for the Harmsworth Cup

The Technical Lessons of a Great Contest

By Thaddeus S. Dayton

The engines of "Maple Leaf IV."

As the English-built "Maple Leaf IV" shot across the finish line on Huntington Bay last Wednesday, winning the international motor boat trophy offered by Lord Northcliffe, which has been held by this country since 1907, Commodore H. H. Melville, chairman of the Board of Governors of the Motor Boat Club of America, challenged the Royal Motor Yacht Club for a return race in British waters next summer. The contest that has just ended taught some very simple but highly important lessons to the American builders and owners of sea-speeders. These will be heeded carefully, and everyone is hopeful that next year the Harmsworth Cup, as it is called, will be recaptured, and that it will be a long time before it crosses the Atlantic again.

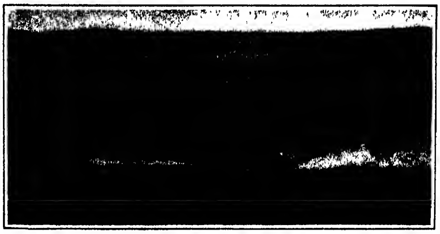
To understand what these lessons were, a brief *résumé* of the three races that resulted in a British victory is necessary. The first "leg" of the three contests was run on Saturday, August 31st. There were three American and two British entries. The American boats were "Baby Reliance II," owned by J. S. Blackton; "Baby Reliance III," owned by Mrs. J. S. Blackton; and "Ankle Deep," owned by Count C. S. Mankowsky. The British boats were the "Mona," Marquis of Anglesey owner, and "Maple Leaf IV," the property of E. M. Edgar.

"Baby Reliance II" is a black-hulled boat, twenty feet long, driven by one motor of eight cylinders and one hundred and fifty horse-power. Bernard Smith was the helmsman and W. Bugh the mechanician. "Baby Reliance III" is twenty-six feet long, driven by a motor similar in size and make to that in "Baby Reliance II." Jay Smith was her helmsman and Wallace Van Nostrand the mechanician. "Ankle Deep" is a Crane designed boat, finished bright. She is thirty-two feet long, driven by two motors of eight cylinders each, her total horse-power being three hundred. She has two propellers and two rudders. Count C. S. Mankowsky steered the boat. His mechanician was Frank Drennon.

The British boats are both built of mahogany and finished bright. The "Maple Leaf IV," 39 feet 11 inches long, is a Fauber multiple-step hydroplane, driven by two sixteen-cylinder motors of three hundred and fifty horse-power each. She has two propellers and two rudders. Tom Sopwith, the aviator, was helmsman and Arthur Allison mechanician. The "Mona" is twenty-six feet long, Thornycroft designed, driven by a motor of one hundred and fifty horse-power. Montague Batting, her designer, had the wheel, and Frank Murtagh, who was in the "Pioneer" last year, was mechanician.

The course was thirty nautical miles, or four times around a triangle of seven and one half nautical miles, in the sheltered waters of the bay. The weather conditions of this first day's race were ideal for the American boats. At no time was the water ruffled enough to make the going bad.

This first contest was won by "Baby Reliance II" in forty-eight minutes and thirty-nine seconds. Her average speed was 37.11 nautical or 42.73 statute miles per hour. She finished seven minutes thirty-nine seconds ahead of the "Mona." The "Maple Leaf IV" had engine trouble and started more than twenty-one minutes late. All she tried to do was to qualify for the next race. "Baby Reliance III" and "Ankle Deep" also had engine trouble, and came in fourth and fifth.

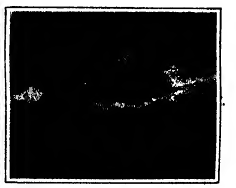


"Maple Leaf IV." Winner of the Harmsworth Cup.

She is 39 feet 11 inches long. She has two propellers and two rudders.

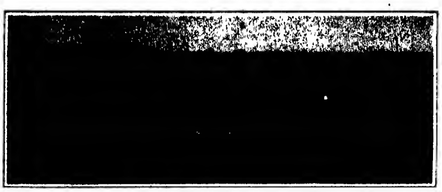
"Maple Leaf IV" at full speed.

Note the height of the wave that she is dashing up.



"Baby Reliance II."

She is 20 feet long, and is driven by a 150 horse-power motor.



"The Mona" making one of her remarkably short turns.

She is 20 feet long and is driven by a motor of 150 horse-power.

"Baby Reliance III" at full speed.

She is 26 feet long and driven by a motor similar in size and make to that of "Baby Reliance II."

The following Monday, when the next heat was scheduled, the weather was so rough that it was agreed to postpone the contest until next day. The victor was the "Maple Leaf IV," "Mona," second, with "Ankle Deep," "Baby Reliance III," and "Baby Reliance II" finishing in the order named.

The wind and sea had been high the day before, but on the afternoon of the race the wind dropped to a gentle breeze. Out on the Sound, however, along the edge of which the boats had to go, there was an ugly swell left over from the northeast gale. The "Ankle Deep" got away in the lead, with "Baby Reliance III" a few seconds behind and the "Maple Leaf IV" three seconds later, her exhausts silent and only the "singing" of her powerful motors to be heard as she plowed a great wide furrow of foam and spray. "Baby Reliance II" was in trouble with her engines and crossed the starting line more than three minutes late. The "Mona" was even worse off, for she was unable to reach the start for eight minutes and seven seconds.

When the boats struck rough water, running west on the base of the triangle, the three American boats got in trouble again and had to stop. Then "Maple Leaf IV," going as steady as a church, took the lead and never was headed after that. The "Maple Leaf IV's" average speed was 27.17 knots (31.24 miles), the "Mona's," 29.13 knots (38.49 miles), "Baby Reliance II," 25.27 knots (29.06 miles), "Baby Reliance III," 25.06 knots (28.81 miles). It should be noted that "Maple Leaf IV's" average speed was more than eleven miles less than that of "Baby Reliance II" in the first heat when the water was smooth.

On Wednesday, the day of the deciding heat of the race, the conditions again were ideal. The greater portion of the course was like a mill pond with just enough breeze to help tone down the heat of the blazing sun. It was "Reliance" weather and water, and everyone was confident that the trophy would remain with us for another year at least. The "Mona" was the first to cross the starting line; a dozen seconds later "Ankle Deep" boomed across, and then, seconds apart, "Reliance II" and "Maple Leaf IV" shot by at their best speed. "Reliance III" had trouble in getting her engines awake, and was the last to start.

Up the first stretch "Ankle Deep" overhauled "Mona," and "Reliance III" also passed the British boat. "Reliance II" put her best foot foremost and began to gain on "Ankle Deep." Down the back stretch these two boats raced a length apart, plunging heavily in the water. "Maple Leaf IV" kept up a uniform pace behind them. "Reliance II" finished the

(*Continued on page 232.*)

New Metallizing Process

By Dr. Alfred Gradenwitz

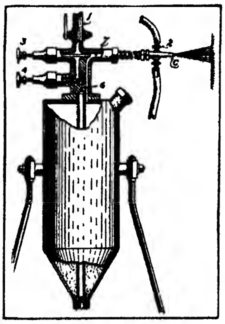
DR. SCHOOP, of Zurich, Switzerland, was watching his children at play with a Flobert rifle when he chanced to note that the bullets striking a wall were crushed thereon, producing a strongly adhering lead coating. This led him to make some experiments with small shot, which brought out the fact that the grains of lead on being crushed form a practically homogeneous layer, provided their surface is cleansed and freed of any trace of graphite.

Although this metallizing process was announced some time ago, the details of the process and the apparatus it requires have only just been made public. In the first metallizer constructed by Dr. Schoop, molten metal was pulverized by a jet of high pressure steam, and projected in a stream of spray upon the object to be coated with metal. This, however, required a stationary apparatus. In the portable apparatus, the molten metal is replaced by a metal powder, which is carried along by a jet of steam or of compressed gas. The jet of gas is heated either by means of a flame or an electric resistance or arc. The particles of metal powder are shot out of the apparatus by means of a jet. The object to be coated with the metal is thus bombarded with a hail of fine metallic particles. At the moment they strike the surface there occurs a transformation of live energy into heat, and this heat contributes to liquefying the particles so as to solder them to one another.

A very convenient form of portable apparatus is represented in the diagram. The mouthpiece C, from which the jet heated by a gas flame is blown forth, is fixed at the end of a flexible tube. The gas enters through the valve 2, into an inner tube fitting concentrically with the passage 7. The air, which is generally at a pressure of five atmospheres, passes through the tube (1) into a chamber fitted with two valves (3) and (4). By turning the valve (3) compressed air is admitted directly into the passage (7), and by operating the valve (4) it is led into the lower half of the apparatus, where it produces a whirl of metal powder, carrying along some of the powder into the conduit (6), then into the conduit (7), and finally into the flexible tube connected with the mouthpiece. The apparatus is mounted to turn on a horizontal axis, so that the last traces of metal may be removed by the compressed air, by tipping the apparatus on its axis.

The apparatus is started by opening the gas valve (2) and igniting the gas. The compressed air admission having been opened, the valve (3) is adjusted until a satisfactory flame is obtained. Then the valve (4) is opened so as to introduce the metal powder. In order to insure a really homogeneous layer, it is essential that no oxide film covers the particles. This is why an inert or even reductive gas and electric heating are used in connection with highly oxidable metals. A striking feature of the operation is that the expansion of the gas is attended by a strong cooling which solidifies the metal rapidly, while the surface temperature remains low; in fact, with such metals it is below 60 deg. Cent. (140 deg. Fahr.). This is why inflammable substances, such as celluloid, as well as flowers and fruits can be metallized. The thickness of the deposit may vary between a hundredth of a millimeter and several millimeters, depending upon the surface to be coated, and on the relative speed of the jet. The latter also governs the hardness and density of the metal coating. This system of metallizing has been used for forming accumulator plates; constructing resistances in the form of a metal thread of zigzag shape; obtaining electric contacts instead of soldering them; and metallizing the clothes of electricians. This last is a very interesting application. If the clothes of electricians are metallized they are protected against high tension current, as in the event of a contact the current would pass through the metallized surface and not through the body of the electrician.

Apparatus adopted by several large French works for zinc, lead and copper plating.



Details of the apparatus for depositing pulverized metal.

NEW METALLIZING PROCESS

The Electric Tow-horse

THE management of the port of Altona had for some time past to face a rather difficult problem that baffled many attempts to solve it. The question was how to transport the wares unloaded at the harbor over two roads of a heavy gradient. As only horse vans had so far been used in this connection, it was considered impossible to replace them all by motor trucks. On the other hand, the horses drawing these heavy loads over mountainous roads proved more and more insufficient to fulfill their task. Finally a compromise between motor and horse traction was settled upon.

In Europe trackless trolley lines are coming more and more to the fore as a welcome substitute for street tramways. Being independent of any strictly limited course and much cheaper in installation, this means of transport doubtless possesses a number of advantages and is operated on a profitable basis where a railway would not pay.

The new hauling service of Altona harbor is based on this system. It is adapted to deal with an average daily traffic of 200 vehicles, each carrying a load of from 5 to 7 tons over two paved roads of about 600 meters in length, which lead at a gradient of 1.18 from the harbor over Kaistrasse and Elbberg as far as the city hall. The pushing and hauling tractors used in this connection are operated by electricity, being fed through a double pole overhead line with 550-volt direct current from the municipal central station. They travel without rails, being able by their trolley arrangement to deviate sufficiently to pass other vehicles. On going downhill, these locomotives travel with the trolley removed.

A train of two or three teams can be hauled by the electric tractor. The horses are not unhitched, but follow in the hauling train, being merely relieved by the hauling locomotives. The coupling devices are so arranged that the vehicles can be uncoupled without stopping.

Each journey of a hauling train, inclusive of the coupling and uncoupling, takes 8 minutes, and as the downhill course takes 7 minutes, four trains can be dealt with each hour by a single tractor.

THE ELECTRIC TOW-HORSE HAULING A TRAIN OF TRUCKS

Swedish Method of Artificial Restoration to Life

By the Paris Correspondent of the Scientific American

A SIMPLE and convenient apparatus for producing artificial respiration has been invented by Dr. K. A. Fries of Stockholm. It is likely to be valuable in restoring animation after asphyxia.

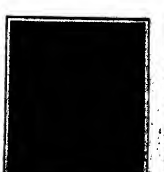
The apparatus is made up of a wooden base in the form of a shield with a part at one end for resting the head, and to this is fitted a light steel frame consisting of a pair of uprights joined by a cross-bar. On the bar are automatic clamp straps for fastening the arm. On the chest a canvas girdle or band is placed so as to compress this part of the body, adjusting properly for size by means of eyelets. The device is first laid on the floor or table and the metal frame folded out, laying the patient on the base, and the wood head-piece then adjusts the head and throat automatically in the right position. We then apply the girdle on the lower part of the chest and fit it snug by the hook and the cord. Adjusting the cross-bar to a good height, we strap the wrists loosely to it, as our engraving shows, then the frame is ready to be operated for producing respiration. The frame carries chains and cords which connect its movements by means of pulleys with the chest girdle, so that the chest is compressed at the right time.

The work of respiration is begun by extending the levers horizontally backward so as to produce inspiration, and in this position the chest girdle lies loose. We then draw up the levers to the vertical and bring them down toward the lower part of the body so as to give the expiration, and here the cords and pulleys act so as to compress the chest band and aid in expelling the air from the lungs. At the same time the patient's tongue is drawn outward by the other hand by means of a handkerchief or ring forceps. The movements are kept up regularly back and forth, keeping time with one's own breathing, or about 16 times a minute.

The device is very compact and can be folded up so as to occupy a space of three feet by two feet by four inches, and may be hung on the wall or stowed away anywhere.

Working apparatus with one hand, and attending to the tongue with the other.

The device and patient ready for the operation. Method of fixing the arms.



The complete apparatus in position for use on the table.

Strapping the wrist bands to the cross-bar. The girdle shown tight across the chest.

SWEDISH METHOD OF ARTIFICIAL RESTORATION TO LIFE

"Chemiluminescence"—the Transformation of Chemical Energy Directly into Light

By F. Alex. McDermott, Research Fellow in Utilization of Fruit Waste, University of Pittsburgh

THE term "Chemiluminescence" has been applied to the production of light by chemical reactions in which the temperature is below that of incandescence. The most common illustration of this is the luminosity of phosphorus and its solutions in various liquids, which give light when exposed to the air. It is probable that the phenomenon of the firefly and similar forms belongs strictly in this class. A considerable number of reactions have been at various times described as giving light under conditions precluding the possibility of incandescence, and an exhaustive review of these has been given by Trautz in the *Zeitschrift für physikalische Chemie*, Vol. 153, pages 1 to 111, 1905. For the most part, however, the lights emitted are rather faint, and often, unless the conditions of the experiment are just right, no light is produced. The three following experiments are rather easily carried out in any laboratory, and may prove of interest to some of the readers of this paper:

1. The reaction of Trautz and Schorigin (see Trautz, supra, and Trautz and Schorigin, *Zeitschrift fur wissenschaftliche Photographie und Photochemie*, 1905): This depends on the rapid oxidation of an alkaline solution of pyrogallol containing formaldehyde. The apparatus which the writer has used to show this reaction consists of a reflux condenser *D* with a bulbed condensing tube, set horizontally, and two or three separatory funnels. (See figure.) In a funnel *A* is placed a solution of 12.5 grammes of pyrogallol in a mixture of 25 cubic centimeters of commercial formaldehyde (37 per cent) solution with 50 cubic centimeters of water, funnel *B* contains a 40 per cent solution of sodium or potassium hydroxide; a third funnel *C* (not shown in figure) contains "Perhydrol" (30 per cent hydrogen peroxide solution). In place of this latter, the usual pharmacopœial 3 per cent solution may be used, in which case this third funnel must be much larger than *A* and *B*, and the inlet for the peroxide solution into the condenser must be larger, to permit of more rapid flow. A solution of hyperol, the urea-hydrogen peroxide compound, made by Richter, Budapest, may be used with advantage in this reaction. A solution of ten or twenty grammes in about 50 cubic centimeters of distilled water will produce a good light. Still more simple, instead of funnels *B* and *C*, a single funnel may be used, as shown in figure, containing 150 cubic centimeters of distilled water in which about 40 grammes of sodium peroxide have just been rapidly stirred. In place of the condenser, a simple glass tube may be used, one of 2 centimeters internal diameter being convenient; the advantage of the bulb tube is that it tends to delay the passage of the liquids to the exit, permitting the greater part of the light-emission to take place in the tube.

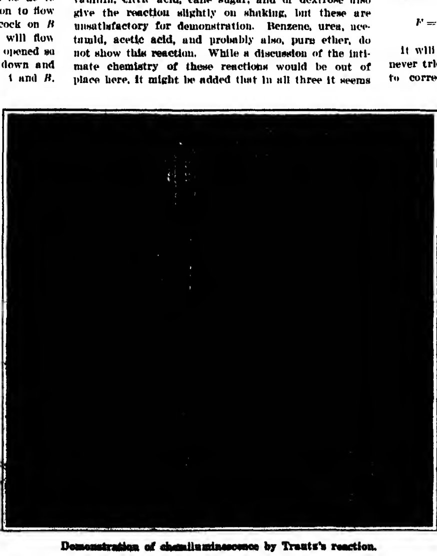
To operate, the stop-cock on *A* is opened so as to allow a slow stream of the pyrogallol solution to flow into the mouth of the condenser; the stop-cock on *B* is then opened so that the alkali solution will flow about as rapidly as the pyrogallol; *C* is then opened so as to permit the peroxide solution to flow down and come in contact with the mixed liquids from *A* and *B*. If the solutions are right, a stream of light will be seen to travel along the condensing tube of the condenser. The light is not by any means as bright as that of the firefly, and this experiment must be performed in a dark room, as must also the following one. The reaction is accompanied by the evolution of quite a little heat, and formaldehyde is evolved. Owing to the formation of dark colored oxidation products of the pyrogallol, the light will appear reddish in color. A little manipulation of the stop-cocks may be necessary to secure the proper results.

2. The reaction of Heckzo (*Chemiker Zeitung*, Vol. 35, p. 199). This reaction depends on the oxidation of phenyl magnesium bromide or iodide by moist air. It is necessary first to prepare the reagent, phenyl magnesium bromide (or iodide) which may be done by the method given in Heckzo's paper. The apparatus necessary is very simple; the compound, in solution in anhydrous ether, may be simply shaken with air in a test tube, or it may be poured onto a piece of moistened filter paper, or it may be allowed to drop from a funnel onto a moistened filter paper. The light is pale greenish, and of about the same intensity as that of the foregoing reaction.

Wedekind has found that when this compound is added to an ethereal solution of chlorpicrin (nitro-chloroform), a green "flame" is produced, which does not ignite the ether.

3. The reaction of Schwersenski and Caro (*Chemiker Zeitung*, Vol. 22, p. 58). This reaction is quite brilliant, and depends on the oxidation of certain organic substances by the gases evolved from potassium permanganate by the action of sulphuric acid. It seems possible that it is not strictly a case of "chemiluminescence," and that the phenomenon may be referable to actual incandescence. The original directions of the authors referred to were to place in a test-tube 3 cubic centimeters of concentrated sulphuric acid, and then to overlay this with three cubic centimeters of alcohol, running the latter in slowly from a pipette, so as not to mix the liquids. A crystal of potassium permanganate is then dropped in, producing an evolution of gas in the acid layer; when the ascending bubbles of gas reach the alcohol layer, they "go off" with a little explosion and a bright flash. After a number of experiments by the writer, it has been found that in place of alcohol, a better reaction is usually obtained with ordinary formaldehyde solution, the permanganate being dropped into the acid before the formaldehyde is run in over it. (Potassium permanganate reacts with formaldehyde, and hence it is impossible to drop it into the acid after the latter has been overlaid with the aldehyde.) Using about 10 cubic centimeters in a test tube 25 millimeters in inside diameter is quite safe; larger amounts are objectionable, on account of the fact that should the tube be accidentally upset, the formaldehyde or other vapor will usually be ignited, especially if larger quantities are used.

In place of ordinary alcohol or the formaldehyde solution, any of the following may be used, though usually with not quite so good results, on account of greater volatility, secondary reactions, or slow reaction; methyl and amyl alcohols, acetone, acrolein and acetaldehyde solutions, lactic acid, amyl acetate, nitrobenzene. Orange oil, aniline, terpineol, and solutions of vanillin, citric acid, cane sugar, and of dextrose also give the reaction slightly on shaking, but these are unsatisfactory for demonstration. Benzene, urea, acetamid, acetic acid, and probably also, pure ether, do not show this reaction. While a discussion of the intimate chemistry of these reactions would be out of place here, it might be added that in all three it seems not unlikely that it is connected with the presence or formation of aldehyde groupings.

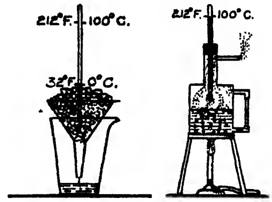


Demonstration of chemiluminescence by Trautz's reaction.

How to Correct a Thermometer

By Norman Barden

THERE are times when the home thermometer varies from that of the Weather Bureau. Invariably it is asserted that the weather man's thermometer is wrong; but let us see whether this be true or not. It is intended here to explain clearly how any body can correct his thermometer by finding the fixed points. The fixed points are the freezing and boiling points. The freezing point is the true fixed point, because the boiling point varies with barometric pressure. The variation of the boiling point must be allowed for, as we shall see later.



Determining the boiling and freezing points of a thermometer.

To determine the boiling point, place the thermometer in position in a boiler as shown in the drawing. Have the boiler about one half full of water, and be sure that the bulb of the thermometer does not touch the water when boiling. Now the water is boiled, and the temperature is taken to tenths of degrees if possible. A magnifier aids greatly in taking temperature readings. Next take the barometer reading, and calculate the true boiling point by means of the formula:

$$T = 100 - 0.0375\ (760 - b)$$

in which b is the barometer reading in millimeters, and T is the temperature of the observed boiling point in Centigrade degrees. Example: Supposing b to be 732.4 millimeters, then solving for T, we get 98.965 deg. Cent.; which is the true boiling point for 732.4 millimeters pressure. The difference between the true and observed boiling points is the boiling point correction.

The freezing point is found by packing the thermometer in finely crushed ice. Leave the thermometer in this position until the mercury ceases to fall. Take an exact reading as before, using the magnifier, and this is the true freezing point or zero. Now, divide the number of degrees between the observed zero and the true boiling point by the number of degrees between the observed zero and the observed boiling point. This gives the thermometer correction per degree. Example: Suppose the observed boiling point was 98.8 deg. Cent., and the true boiling point was 98.9 deg. Cent., also that the observed zero was exactly at zero degree on the thermometer. Then,

$$98.9 \div 98.8 = 1.001,$$

or the correction of one degree. That is, if the temperature on the thermometer read 1, the real temperature would be 1.001 degree, or if the temperature read 20 degrees, the real temperature would be 20 × 1.001, or 20.02 deg. Cent.

Most thermometers will have a correction of a degree or more. In this article Centigrade readings have been used, but the method for Fahrenheit thermometers is just the same. If it be desired to convert Fahrenheit into Centigrade or *vice versa*, this may be done by substituting in the following formulas:

$$F = \frac{9\ (C - 32)}{5} \qquad C = \frac{5\ (F - 32)}{9}$$

It will be found quite interesting for those who have never tried to find the true freezing and boiling points, to correct one's thermometers in the manner described, and then have the satisfaction of being able to find the correct temperature at any time.

An Inexpensive Oxygen Retort

By John Phin

OXYGEN is sometimes prepared by heating chlorate of potash and some inert substance in a glass flask or even in a large test tube, but glass vessels are so easily broken that metal retorts are usually preferred. The retorts offered by the makers of chemical apparatus are quite expensive, but one equally as good may be had for a trifling sum from any plumber or gas fitter. The one fuse is simply a piece of gas pipe 15 inches long and 1½ inches in diameter. One end is closed by screwing on a common cap such as is used by gas fitters, and the other end is squared up and the inside reamed out smooth and slightly conical, so that a good sound cork may be used to close it. Through this cork is passed a glass or iron tube on which is slipped the rubber tubing used for delivery. With a good cork and reasonably tight-fitting joints both for the 1½-inch tube and the smaller tube, this retort will sustain considerable pressure without loss. It may be heated in a common stove by holding the corked end in the hand. Two ounces of chlorate of potash with an equal bulk of black oxide of manganese or even clean, fine sand will produce four gallons of oxygen.

Extracting a Lion's Tooth

TOOTHACHE seems to be a concomitant of civilization. Civilized people with perfect teeth are comparatively scarce. Uncivilized and even semi-civilized people give their teeth no care, and yet they remain white and sound; but let such people move to a civilized land, and dental troubles will be sure to develop. The Bulgarian peasant knows neither toothbrush nor toothache, while his fellow townsmen suffer greatly from caries. The same seems to be true even of wild animals. When, as captives, they are brought into touch with civilization their teeth not infrequently yield to our highly civilized disease, and the surgeon of the zoo is obliged to operate upon them. As may well be imagined, his task is no simple one in the case of large ferocious animals. The accompanying photograph illustrates such an operation recently performed at the White City Jungle, London, by Dr. Watt, a West London veterinary surgeon. The patient was a lion cub, fourteen months old, which had been suffering with toothache for some time. He was drawn up against the bars of his cage and held firmly with ropes; then his mouth was kept open with chunks of wood while the surgeon drew the decayed molar. The tooth may be seen in the surgeon's pliers at the right of the picture.

Readers are invited to contribute photographs of novel and curious objects, unique occurrences and ingenious contrivances. Such as are found available will be paid for promptly.

By courtesy of the Sphere.

Extracting a lion's tooth.

By courtesy of Flight.

Putting the helmet to test.

Moving a house by boat.

Scout aviator making phonograph records and dropping them to the ground for reproduction.

A pair of pigmy hippopotami from Liberia.

Moving a House by Boat

A CHICAGO real estate dealer recently bought a two-story colonial house on East End Avenue, Chicago. In that location the investment did not appear to be gilt-edged, but the dealer knew that the same house, located in another section of the city, would find a ready sale at a greatly appreciated price.

To move it in the ordinary way on land to that other district would have entailed expense so great as to wipe out the profit he hoped to make. So he decided to move the house by water. Set upon the ordinary skids, the house was hauled to the shore of Lake Michigan. In order to get the house upon the barges and scows on which it was to be towed along the lake shore, it was necessary to build a pontoon, and this operation had to be repeated when the house hove-to off the site of its new location.

Two large scows were lashed together and moored close inshore. Anchored fore and aft and snubbed up on the shore, the scows were held firmly in place, and then guyed by heavy hawsers, the house was skidded upon the scows.

A dozen "husky" stevedores warped the combination offshore, a tug hitched a hawser to the scows, and one hour later the house was snubbed up against the shore twenty-four blocks south of the starting point.

In less than forty-eight hours time all told the house was reposing on new foundations at Lake Avenue. The entire distance, by land, was more than three miles. Fortunately there were no squalls or other weather disturbances to interfere with the work.

Phonographs for Aviation Scouts

ACCORDING to experiments made at the Buc aeroplane grounds, near Paris, it is no longer necessary when scouting to carry a second man acting as observer. The pilot can make all the records of the flight by speaking into a specially arranged phonograph. This was tried with good success on a Farman aeroplane piloted by Capt. Barès, who was accompanied by M. Jules Richard, the inventor of the new "Roneophone," as it is called. In ordinary cases the pilot, when alone, is not able to note down all that he sees, for even should he be able to write, he must then cease to observe. With the new phonograph this drawback is overcome, and without ceasing to steer, he dictates his observations into a speaking tube. This connects with the phonograph so as to make the record. The record is made on a disk, which when filled may be put into a box and dropped from the aeroplane at any point, while a fresh disk is used for another record. It appears that the noise of the motor does not prevent making a good record of the voice upon the disk. During the flight, M. Richard noted all the interesting points on the ground by speaking into the apparatus, and afterward when alighting the record could be very well heard. All the aeroplane officers of the Buc grounds were impressed with the results.

Safety Helmet for Aviators

ONE of the pupils of an aviation school in England has recently devised a headgear which is adapted to protect the wearer from shocks or blows. A writer in *Flight*, our English contemporary, from which the accompanying illustration has been culled, states that he had the pleasure of belaboring the inventor over the head with a piece of scantling while he stood passively smiling, without feeling the blow in the least. Then, in order to test the device, it was suggested that the inventor take a running leap full tilt at one of the hangars. This he did, as the photograph shows, and without injury to himself. The headgear is of leather well padded with horsehair and contains a system of flat steel springs, which have the effect of distributing the shock sustained by them over a large area.

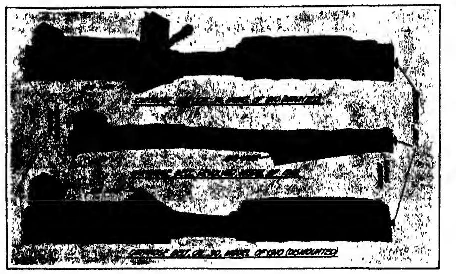
First Pigmy Hippopotami in Captivity

THE New York Zoological Society has just secured some of the rarest animals of the African fauna, a unique pair of pigmy hippopotami from the interior of Liberia.

Though first discovered sixty-eight years ago by Dr. S. J. Morton, of the Philadelphia Academy of Sciences, they have remained practically unknown, as no hunter or explorer has hitherto succeeded in capturing one alive. The two shown in the accompanying illustration are the first living specimens to be exhibited in civilization.

The animals were obtained from Mr. Carl Hagenbeck of Hamburg, and cost $12,000. A special expedition was equipped for their capture in charge of Maj. Hans Schomburgk, an intrepid hunter and explorer. With a caravan of 100 men he penetrated the dense and roadless Liberian forests 200 miles or more from the coast. After many months of dangers, hardships and continual hunting the pigmy hippopotami were located on the upper Lofa River. Here in their remote haunts about 100 pits were dug in various places to trap the animals. The pits were seven feet deep, and were carefully covered so that the sharpest eye could not detect any signs of danger. In these the pair of dwarf hippopotami, male and female, were caught. Maj. Schomburgk states that unlike their big cousins, the pigmy hippopotami do not frequent the rivers. They make their home deep in the inhospitable forest, in the dense vegetation, on the banks of the small forest streams; but, not satisfied with the protection the forest affords them, they enlarge the hollows which the water has washed out under the banks, and in these tunnels, where they are invisible from the bank, they sleep during the heat of the day. It is very hard to even find a place where there is the slightest chance of catching one, because this animal roams through the forest like an elephant or a pig, usually going singly, though sometimes in pairs, and rarely using the same track twice. The legs of the pigmy hippopotamus are longer and more slender in proportion than those of the larger species, and its eyes do not "pop" out of its head. Another striking character is the long tail, twelve inches in the adult male, which in proportion is about twice as long as that of its giant living relative. The face of the pigmy is relatively smaller, which brings the eyes nearer to the median line of the skull. The two hippopotami pictured are about 3½ years old, stand less than two feet high and weigh nearly 200 pounds each.

*The Bussicott cook stove.



Variations of the Mills army belt.

Inventors and the Army and Navy

The Government's Attitude Toward Inventions on Paper

By William Atherton Du Puy

AMONG inventors there has grown up a pretty general conviction that in the military branches of the Government, the Army and the Navy, there is much discrimination in favor of the men who are in those services as against the independent worker. They hold that the man on the outside who invents anything new in the way of ordnance, projectiles, armor or what not, has a much less chance of selling his patents to the Government than does the inventor of the same things who is in the service.

There is some basis for these charges. It is true, in the first place, that the Army and Navy departments habitually refuse even to consider inventions that are offered by outsiders and that there may be such ideas as would be of much value to those services. These departments do, as a matter of fact, refuse to examine practically all patented articles that are merely on paper. Any important article to be purchased by the War Department or the Navy Department must first have its utility very thoroughly demonstrated. It must be tried in actual operation. If it is a gun that is supposed to shoot five miles, the gun must be actually made and its ability to carry the given distance must be demonstrated in the field. If it is a powder that is intended to drive a given projectile through a given thickness of armor, the powder must be manufactured and shown actually to accomplish what is claimed for it. If it is a tent that is intended to resist certain weather conditions and wear for a certain number of years, the time necessary to demonstrate those points will be taken by the Government.

The man in the service knows these things. When he makes an invention that he wishes to sell to the Government he never goes before the proper authority with mere sketches of his article. He has it in the completed form and has made every arrangement to demonstrate it in actual operation. On the other hand, the civilian inventor goes to the department with the mere plans for an invention. He is not in a position to make a proposition to the department upon the basis on which it does business. He is not given any consideration. He feels he has been discriminated against. As a matter of fact, he has failed of an ample hearing because he is not prepared effectually to demonstrate his article.

Aside from this, the department is constantly working from the inside to improve its ordnance. The Government does not, however, patent its inventions in advance of their demonstration. At the time the outside inventor lays his patent before the department it may be that the same problems are being worked out. If an inventor offered an aeroplane gun to the Government to-day it would be more than likely that some of his ideas would be in conflict with some that are just now being worked out in the Government gun factories, for the Government is very busy along these lines. Unless this inventor had his gun completed and was ready to demonstrate it (an improbable condition) he would be given little consideration. Later the same ideas might appear and he would believe they had been stolen from him, while, as a matter of fact, they had been merely called out by the needs of the time.

The man who is in the Army or Navy quite naturally knows a great deal more of the needs of those services than does the man on the outside. This makes it more probable that he will make inventions for which there is an active demand. When this advantage is added to his knowledge of the particular manner in which such inventions must be presented, it is not surprising that the civilian finds that the inside man is getting the call on the majority of the improved devices.

Again, it may happen that an outside inventor may demonstrate an article which is greatly needed by the Government. He may present his case to the general satisfaction of the given department. That department may want to buy his invention. There is, however, no money available for the purpose. There may be years of delay in getting from Congress the needed money. The man in the Government service is accustomed to deal with governmental delay and red tape. The man on the outside is prone to think that he is being trifled with, to become disgusted with the delay, and to cease diplomatic relations. Here again the fault is not in a discrimination against him but in his lack of an understanding of the exigencies of dealing with so cumbersome a customer as the Government.

If the outside inventor finds that the Government is infringing his patents, here again are conditions which convince him that the Government is attempting to do him an injustice. The Government long had the right to seize, under the law, whatever it chose in the way of an invention and make use of it. The Government might not be sued and there was no chance of getting results through the Court of Claims. The Government maintained that it was favoring the inventor in protecting him from his rivals and that there was little reason why it should grant this protection to its own loss. Until quite recently it has therefore not been unusual for the Government to freely help itself to whatever it chose in the way of patents.

Many inventors have succeeded in getting pay for their patents by means of special bills through Congress. The Government moves slowly in the payment of any claims. Its officials are very conservative in the expenditure of money. They do not pay claims as long as there is any other action they may take. These officials thus assure themselves against any possibility of being held responsible for expending money when such action was not justified. Many an inventor has gone hungry while waiting for the money on a perfectly good claim that rested in some Treasury Department pigeonhole.

The Government three years ago came to the conclusion that it was making a mistake in not allowing whoever made an invention which it used to profit thereby. It got the idea that if patents for appliances were paid for, the development of patents helpful to the Government would be encouraged. A law was consequently framed by the Commissioner two years ago and it finally passed. To-day there is a chance of sale of a patent to the Government that is comparable with the chance of sale to any other large business concern, and the Government now protects the recipient of a patent from Federal infringement as well as infringement by private individuals.

But conditions have long been such as to lead the inventor to believe that there is a conspiracy to keep him out of governmental recognition and from realizing upon his inventions. The facts probably are that he is merely up against a condition that exists in the departments and that there is no favor whatever shown to the inside man. He must learn the method in which patented articles must be presented to the Government and he must satisfy himself with the deliberate manner in which the Government settles perfectly good claims.

When the civilian fails to sell a patent to the Army or the Navy and he feels that he has been done an injustice, he freely voices his discontent. The public hears more or less of this dissatisfaction. Just the opposite is true of the man in the service. When he fails to get his invention accepted he may protest in his inner circle but there is little heard on the outside. This is because of a very peculiar and interesting condition with reference to inventions that exist in the Army and Navy and because of which the service inventor is at heart more bitter, in many cases, than is the man on the outside.

Almost from the beginning of the Government it has been a matter of sentiment and of more or less general practice that the man in the service making an invention should not consider it as his own but as something accruing to the service with which he is associated. There is a departmental order to this effect in the Department of Agriculture. In the War Department and in the Navy Department this rule has been enforced. There is no departmental regulation which places any stress upon the inventor or in any way makes it necessary that he should donate his invention to the Government.

The legal aspect of the matter has been definitely settled. The decision of the Supreme Court of the United States in the case of the United States v. Burns defines the rights of any officer or employee of the Government in his patented invention. That decision is, in part, as follows:

"If an officer in the military service, not specially employed to make experiments with a view to suggest improvements, devise a new and valuable improvement in arms, tents, or any other kind of war material, he is entitled to the benefit of it and to letters patent for the improvement, from the United States, equally with any other citizen not engaged in such service; and the Government cannot after the patent is issued make use of the improvement any more than a private individual without license of the inventor or making compensation to him."

But despite all this there is a general prejudice against the man of the Army or Navy making any money out of inventions. It is held that these men have been given their technical education by the Government and that they have drawn salaries from the Government during the time they have been evolving these inventions. Therefore the inventions should be the property of the Government. The public is inclined to this belief. The majority of the men in the service either favor this construction of their duty or yield to public opinion. It is true that great numbers of very valuable inventions are thus given these services every year.

On the other hand, the Government has repeatedly paid for the inventions of its officers. The occasions are too numerous to mention, but reference may be made to a few. There is, for example, the Mills Woven Cartridge Belt, the Dashiell Breech Mechanism, the Fiske Telescopic Sight, the Lewis Range Finder, the Driggs-Schroeder Gun, the Fletcher Breech Mechanism, the Sibley Tent, and a great many others. The list of Army and Navy officers that have been pecuniarily benefited by their patented inventions would be almost endless.

Probably the greatest success among the Army inventors has been Brigadier-General Anson Mills who has made a large fortune through the cartridge belt that he called into being. When Gen. Mills was doing scout work in the West many years ago he was greatly annoyed by the fact that the army belts were constantly coming unsewed and failing to serve the purpose for which they were intended. He devised the one-piece woven belt that is now in use. When he had completed his belt he offered it to the Army through the proper channels but it met with no favor. He wanted to sell it abroad and sought a manufacturer for it. There was no machinery

that would weave it. He then invented a weaving machine to make this particular product. He took the machine and the belt abroad and sold them to different European governments. Thus encouraged he returned to America and finally succeeded in selling to the War Department and, having been at first turned down, forced the Government to pay him a handsome price. It is not known just what his royalties have been, but the figures of business in this belt done in a single decade show that more than a million and a half dollars' worth of them were used. Gen. Mills is now retired, and out of the proceeds of his belt has built a large and handsome office building just across the street from the War Department, and this he rents to the Government, and it accommodates overflow bureaus from that department.

The Sibley tent is an invention that has drawn a lot of money from the War Department. H. H. Sibley patented it in the late fifties and entered into partnership with Maj. William W. Burns, and these gentlemen sold tents to the Government, receiving $10 each on the first fifty and $5 each on 3,600 that immediately followed. When the Civil War broke out Sibley identified himself with the Confederacy, and thereafter he received no royalties. Maj. Burns remained loyal and continued to receive his proportion of the royalties which aggregated something like $120,000.

Maj. D. M. Lissak, U. S. Army, is the inventor of a machine for the manufacture of cartridge clips. This machine has been in use in the Government arsenals for many years, and it is claimed that it saves the Government some $40,000 a year. The Government entered into no contract with Lissak for its use, and he had derived no benefit from his invention until, in 1905, a bill was introduced into Congress awarding him a lump sum of $25,000.

Francis H. Buzzicott was a private in the army and assigned to the mess squad. In connection with his work in the field he devised a range for baking bread. These ranges were remarkable for the amount of bread they would produce in a given space and for their lightness of weight. They immediately found favor in the Army. Altogether nearly $200,000 worth of them has been bought by the Army. They are manufactured by a company to whom Buzzicott assigned his patents, and the amount of his royalties is unknown.

Capt. Thomas Franklin, U. S. Army, has made a more typical invention. He worked out a potato-peeling machine, the manager of the laundry at West Point collaborating with him. They assigned their patents to a manufacturing company in New York, and to date there have been some hundreds of these machines sold to the Government at $250 each, out of which it is reasonable to suppose the inventors have received a fair royalty, and the end is not yet.

Lieut. H. C. Mustin, U. S. Navy, is the inventor of a telescopic ordnance sight which is used in the Navy. The owners receive, through an agreement authorized by the Secretary, $50 each on these sights purchased by the Navy. The first purchase was sixty-six sights, which netted the inventor the neat sum of $3,300.

Philip Hichborn, Chief Constructor of the Navy, retired, is the inventor of the Franklin life buoy, a circular float with a patent torch that flares up when the apparatus hits the water. The inventor received $50 for each buoy during the life of the patent, and since the seventeen years allowed him because of his protection expired, he has been receiving $25 each royalty, as a result of which he has become a very wealthy man.

J. A. Mudd, Pay Inspector of the Navy, invented a carrier for pneumatic tubes, which he sold for $1,200; Commander William Little of the Navy, a boiler tube stopper, which is now in use in every ship of the Navy. He has never received any money for it, but maintains that the Government should pay him one dollar for every stopper it is using. George F. Schild, a naval architect, invented at Mare Island a caisson gate, which the Government built into a drydock at an expense of $60,000, thereby saving itself $40,000. Schild sued the Government, but there was no way in law that he could collect, as this was previous to the passage of the legislation that enables the Court of Claims to award inventors. L. G. Billings, a Pay Director in the Navy, patented an emergency food, selling his patents for $500 in cash and two cents a can on all that was sold. The Government has been using adaptations of this food ever since. So might the list be continued indefinitely.

The man in the service is, therefore, embarrassed by a semi-established custom of dedicating his patents. If he is not treated as he feels he should be when he offers his patents for sale he rarely makes much public clamor in the matter. It is, therefore, taken that he is well satisfied with the treatment he receives from the Government, and his silence, when contrasted with the clamor of the civilian, is taken as an indication of a different treatment accorded him. With all the facts in mind it would seem probable that the inside man in the War or Navy Departments has a much less chance of profiting by his inventions, particularly if they were presented with no better understanding of the particular needs of the case, than has the civilian.

It is unquestionably true that both the War Department and the Navy Department are vigilantly on the lookout for any invention that will improve any one of the thousands of things that go to make up the equipment of either of those services. Particularly since the passage of the law of two years ago is there an excellent opportunity to sell to these departments patents that may be demonstrated in such a way as to show the advisability of their purchase. A survey of the whole situation would lead to the conclusion that either civilian or service man has an excellent chance of getting some of this Federal money if he but knows the advisable method of placing his invention before the department, and if he but accepts philosophically delays that are sure to come and bides the time of ultimate settlement.

Notes for Inventors

A Non-renewable Incandescent Lamp.—In patent No. 1,034,722, to General Electric Company, assignee of M. M. Merritt of Middleton, Mass., is shown a non-renewable incandescent lamp in which a filament is arranged in a bulb and means are provided for defacing the walls of the lamp space when the lamp is violently heated.

Combines Coffee Pot and Tea Pot.—In a body of conical form a partition is arranged to provide two compartments, one for tea and the other for coffee. The compartments have individual spouts, each with a valve, and they also have separate lids or covers, and either or both of the compartments may be used as desired. The patent, No. 1,035,407, was issued to James R. Beaseley of Lynchburg, Va.

Novel Disposition of Aeroplane Planes.—Dickran G. Terzian of Washington, D. C., has received patent No. 1,035,660 which shows an aeroplane with a frame and front and rear pairs of upper and lower sustaining planes, with the planes of each pair extending in opposite directions and lapping at their inner ends. The upper plane of each pair is at the same side of the frame as the lower plane of the other pair.

A Baltimore Heater.—In a patent, No. 1,034,465, to James M. Kennedy and James O'Hara of Baltimore, Md., there is shown on the sloping roof of a house a solar water heater, in which a glass covered box contains a number of thin flat hollow metal sections connected to form practically a coil and exposing their flat faces to the rays of the sun, supply and delivery pipes being supplied to circulate water through the heater.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of General Interest.

HORSESHOE.—E. E. COOK, Springfield, Union Co., N. J. Mr. Cook provides a new and improved horseshoe arranged for convenient and quick attachment to the animal's hoof without the use of horseshoe nails, and to allow of readily replacing worn out calks with new ones and insuring long life of the horseshoe.

MEDICATED AIR COMPOUND.—J. CONNEAY, 4632 Bell Ave., St. Louis, Mo. The object of this inventor is to provide an atmosphere in a suitable inclosure or room impregnated with suitable chemical particles of dust, which co-act one with the other, purifying and impregnating the air, and which are adapted to be breathed, with the air, into the lungs of animals.

DISINFECTING AND SPONGING APPARATUS.—S. BARUCH, 783 Beck St., Bronx, N. Y., N. Y. This apparatus is especially designed for use by tailors in small tailor shops, and is so constructed that the disinfecting gas after performing its work on clothing or other articles is driven through a suitable conduit leading to the outside of the building, so that it will not make its presence known in the shop.

Household Utilities.

ATTACHMENT FOR MATTRESS FRAMES.—O. GASAU, New York, N. Y., care of Gasau Spring Bed Co., 28-32 Cumberland St., Brooklyn, N. Y. This invention is more particularly for use in connection with and as constituting an essential part of the frames on which woven wire mattresses are supported in stretched form. It supplies supporting means for the mattress frame capable of adjustment to adapt the mattress to beds of different widths.

CLOTHES DRIER.—P. D. RIORDAN, 1047 Lexington Ave., New York, N. Y. This invention provides means for furnishing an apparatus by the use of which clothes hung upon it near the street level may be thereafter lifted to any reasonably desired height, such as that of an ordinary building, thus taking advantage of the cleaner, purer and better circulating strata of air at such heights.

COOKER ATTACHMENT FOR FURNACE DOORS.—C. F. HOFFMAN, care of Tuttle, McArthur & Dunrieback, 501 Hollister Bldg., Lansing, Mich. This device is readily attachable to and detachable from a furnace door, at the inside thereof, so that when the door is closed a basket or equivalent receptacle forming a part of the device will be supported over the bed of live coals in the furnace for the baking of potatoes and the cooking of other food.

Designs.

DESIGN FOR A CARPET OR RUG.—W. E. SAYERS, Thompsonville, Conn. Mr. Sayers has invented four new original and ornamental designs for a carpet or rug. The series run from patent No. 42,893 to 42,896, inclusive. Each design shows richly planned and elaborately executed patterns involving many features in a wide range of artistic and formal effects. All except No. 42,896 have the characteristics of precision of outline amid a field of beauty, while the number just named is successful by a composition less definite in its field, but of crisp outlines.

DESIGN FOR A CARPET OR RUG.—J. G. PROBL, Thompsonville, Conn. In this design the main border is edged by scroll work inclosing flower patterns. The center piece and a garland, or circle, in the body of the rug have the same attractive features as the border.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12680) C. C. asks: In a heavy storm how far below the surface of the ocean will the wind have an effect on the water? About how much of the surface does the wind drift, or how far below the surface will an object have to be that a storm will not affect it? A. There are instances on record in which the effects of the waves of a great tempest have been known to reach about three-quarters of a mile below the surface of the water. Telegraph cables have been disturbed at that depth in the Wyville Thomson Sill, a depression in the ridge which separates the basin of the Atlantic Ocean from that of the Norwegian Sea. Of course, the effect of the wind upon the water varies so much under different circumstances that no simple rule can be given which will cover all cases, and generally the depth to which an ordinary storm disturbs the water is not great. Probably stone work will not be overturned below a depth of 40 feet, though perceptible motion of the water may be detected to about 350 times the height of the wave, as is shown by experiments in the laboratory. We have no figures for the drift of the surface in a wind. Where there are no currents, it would not be very far.

(12681) U. S. W. asks: I once participated in an experiment where four persons lifted from the floor on which they stood a fifth person, weighing 135 pounds, upon the tips of their index fingers. I being one of the four, remember very distinctly that the party whom we raised from the floor apparently did not weigh one pound, but rather seemed to be sustained by some unseen force; while to the party who was being lifted, according to his own statement, the word *weight* had (for the time being) lost its meaning. He stated his body seemed to be unaffected by gravity. Would you kindly refer me to some work treating on the subject? A. We do not know any book in which the experiment of lifting a person in the manner you describe is explained. We are called upon very frequently to explain it, and will give you our explanation. Four persons lift a person weighing 135 pounds. Each one of the four lifts about 34 pounds. That in itself does not call for any great effort, even when done by the index finger alone. The writer has lifted 150 pounds with his little finger. When you lifted the 34 pounds, you were all required to do something else at the same time, were you not? Usually the one directing the experiment requires that all, including the person to be lifted, inhale the breath forcibly and absolutely at the same instant, and to lift at exactly the instant at which they breathe. The natural result of concentrating the mind and all the mind and attention upon breathing, is that every one is totally oblivious to the amount of effort put forth as lifting. You think you do not lift at all, but in fact you lift one-fourth of the weight of a person. Try it on something which four people cannot lift with their index fingers, and you will find that gravity has not been suspended. The explanation is psychological.

(12682) S. G. M. asks: I shall be greatly obliged if you will kindly decide the following dispute. I claim that time has always existed, while my friend maintains that time began when the world began. Which is right? A. "Time" is usually defined, "a measured portion of duration." It is from the Latin, *tempus, temporis*, from which we get our words *temporary, temporal*, and others. One derivation of the word is from the Latin verb *tendere, tensum* or *tentum*, which means to stretch out or cover over. From this verb we have *tense* in grammar, the time to which an action is limited; *tent*, a cloth stretched over one for a cover, and many others. Duration has no limit. It is endless. From its derivation time must have limits, a beginning and an end. All our words for periods of time express this thought: a second, a minute, hour, day, year, century, etc. Eternity expresses limitless time, but usually in one direction only. In common speech we say there has been an eternity past in which time began. There will be an eternity to come in which time will end. When time began, and when it will end, we do not know. We can, as we do, begin the measuring of time from any event—the year 1912 of the Christian era, or the year of the world, if we knew its number, but this is an arbitrary method of reckoning. There is no natural unit of time. The best one we have is the day, and that is variable, the astronomers tell us. You see we cannot agree with either of you. We do not think time has always existed. Creation was at the beginning of time; but that was before the world was evolved from the original nebula. All our chronologies are of our own invention, useful for our own purposes, but not natural, and at some time to come to an end. Do you say, "This is more logical and theological than scientific?" Well, perhaps. We do not decide which of you two friends is wrong, if either is, or assert that we are wholly right. In many things much depends upon the definition, the limit from which you set out in determining the terminus to which you come.

Grenadiers of the Air

(Concluded from page 215.)

believe the statement published in Germany on August 15th, as coming from a "really reliable source," an engineer there has succeeded in constructing an aeroplane, which by an ingenious mechanism can remain suspended for a considerable time in midair. Before accepting the announcement we must wait. Still, sights to meet such a case as this have been thought out, one such being an arrangement of mirrors for use at night when attacking warships at sea. The aerial destroyer is supposed to be maneuvered above a vessel until the glare from her funnels is seen reflected in the mirrors, when the pressure of a button causes a dynamite bomb to drop vertically onto the target.

These plans are excellent no doubt as far as they go, but they leave out of consideration the fact that the noise of the engine on a calm, still night would very probably betray the approach of the aircraft, if an aeroplane—the insistent rattling hum of M. Salmet's machine along the coast line of the Isle of Thanet is in my ears as I write; and to silence the engine may involve loss of power at a critical time.

Again, although we have no actual experience on the effect of the bomb-dropper's flying machine of the explosion of a heavy charge of, say, dynamite on the ground-surface vertically beneath, it may be assumed that he would be safer at some distance in a diagonal direction from the point of impact, so as to be clear of the *upward* effect of the explosion which must cause a considerable disturbance of the air in its neighborhood by concussion. It would be better therefore on this supposition that the bomb should be delivered while the flying machine is on the move, and to meet this condition the best apparatus which has yet been tried on occasions open to the public and of which records are available for publication, is the one which scored a victory for the United States in the person of Lieut. Scott this year in the Michelin Target Competitions, for bomb-throwing from aeroplanes, in France. These, after being open for a considerable time, finished in the middle of August and the American officer, in a monoplane piloted by the French aviator, M. Gaubert, succeeded in winning the $1,000 Michelin prize for dropping fifteen bombs into a circle 66 feet in diameter from a height of 656 feet by placing twelve out of the required fifteen projectiles within the area of the target. He had previously made an almost equally good record by dropping eleven out of fifteen into the circle. Also in the previous week he had won the prize of $5,000 for dropping the largest number of bombs into a rectangular space of 170 by 40 feet from a height of 2,400 feet.

These results are quoted from the Paris correspondent of an English daily paper. Without having been actually present at the competitions it is impossible to judge how far the conditions approached those of war, except as regards the height of drop, but Lieut. Scott's apparatus has been described in the SCIENTIFIC AMERICAN of October 28th, 1911 and the British *Aero* for March, 1912. Although, like any other mechanism of a similar kind, it must require perfect co-operation, as the result of practice, between pilot and bomb-thrower, it is far and away the best and most practical which has yet been heard of. The German authorities have carried out careful experiments from time to time and are understood to have satisfied themselves that the dirigible forms a better carrier and platform for the bomb-dropper than the aeroplane. The firm of Zeiss, the well-known opticians of Jena, have brought out a sighting instrument, but the particulars of this, like those of the German experiments, are kept secret at present.

It is significant that the various large dirigibles which are being built to contract for the French and German governments are all designed to carry considerably more weight than is required for engine, crew, fuel and oil, the presumption being that a margin is allowed for explosives. In some cases it is specifically stated that special

apparatus is to be carried for dealing with explosive projectiles. We may therefore assume that bomb-dropping is considered as a serious proposition by those nations who are most likely to have occasion to practise it.

A single aeroplane may be a negligible quantity as an engine of destruction, but a fleet of a hundred or so machines, working in sections, well organized, with carefully trained pilots and bomb-droppers and systematic methods of ammunition-supply, may be a very formidable instrument in the hands of a capable commander.

It must be remembered that a regular bombardment is a singularly inefficient method of getting results; as a man-killing projectile the dropped bomb will probably be of inferior value, and the expenditure of time and energy required to fly to the scene of action, with the small number of projectiles which can be carried at present, and return at intervals for fresh supplies will be very exhausting to the airmen, and cause considerable wear and tear of the machines. The trained pilot and his aeroplane form between them a unit which for some time to come will be too valuable for purposes of reconnaissance to be employed for bomb-dropping, unless under very exceptional circumstances.

Such circumstances might well be considered to exist where the destruction of a specific nerve-center in an enemy's country could be accomplished by no other means and might cripple his organization and have far-reaching consequences, or in naval warfare when the location of a mine or of a submarine from overhead and its destruction could only be accomplished by aircraft. In the latter case the clever naval airman will probably be able to bring his hydro-aeroplane close above the submarine, drop a charge of explosive, arranged to act under water, and be well out of reach of the concussion before the explosion takes place.

To the impartial observer with an open mind and some military experience the question of dropping projectiles from aircraft is a difficult one at the best, and by the light of such information as is available at present it would be extremely unsafe to dogmatize—the data are insufficient. All we can be sure of is, that there are great latent possibilities of aggressive action.

The Gnome Rotary Engine

(Concluded from page 279.)

valves in the Gnome engine are removed with the greatest ease, special socket wrenches being supplied for the purpose.

One is prepared for the construction wherein the cylinder is cut from a solid bar of steel, but one is genuinely surprised to learn that the crank case is also cut from a solid drop forging. In the rough, this forging weighs no less than one hundred and six pounds, which weight is reduced in the finished crank case to thirteen and one half pounds. Starting with one hundred and six pounds, no less than ninety-two and one half pounds of steel shavings are produced in the manufacture of a thirteen and one half pound crank case. Now, perhaps one appreciates why I said that the Gnome factory was literally turning out steel shavings.

Fig. 8 pictures the finishing of the hollow crank shaft. Upon this crank shaft there is one master connecting rod to which are attached six auxiliary connecting rods for the rest of the seven cylinders. Annular ball bearings are used on both the main bearings, for the thrust bearing to take the thrust of the propeller, and on the large end of the master connecting rod. The large ends of the auxiliary connecting rods and the small ends of all the rods have plain bearings. In operation, the Gnome motor is ignited by a Bosch high-tension magneto. The castor oil, which is used as a lubricant, and the gasoline, are fed by a positive acting piston pump to the hollow crank shaft. The lubricant and fuel then pass through the automatic inlet valve in the head of the cylinder. The inlet valve is most ingeniously weighted by counterweights to compensate for the action of centrifugal force.

Figs. 9 and 10 give a good idea of the method of testing employed at the Gnome factory. The finished motor, together with its fuel and oil tanks, is mounted upon a sort of gun carriage, and in place of a propeller a crude paddle type of dynamometer is fitted as shown in Fig. 9. Careful tests are made in this manner before the finished engine is allowed to leave the factory.

Much has been said regarding the so-called gyroscopic force developed by the rotary engine. To show that this is negligible, Monsieur Seguin took me into the testing room, ran a 70 horse-power motor up to thirteen hundred revolutions per minute, and lifting the tail of the gun carriage (the whole is nicely balanced about the wheels), handed it to me so that I could change the plane of rotation of the rapidly revolving mass. This I did, and unless I made a very rapid movement, much more rapid by the way than a sane aviator would make in flying, the gyroscopic effect was almost unnoticeable. And let me take this occasion to remark that in all of my flights with my 70 horse-power Gnome-driven Blériot monoplane—and I have made in all one hundred and seven flights in the machine—I have never had to allow in the manipulation of my controls for the gyroscopic force, much talked of among "rocking chair aviators." Of course it exists, but I account for the fact that it is negligible in actual practice in that the plane of rotation of the motor is not changed rapidly enough to produce a noticeable gyroscopic effect.

Now as to the future. As far as I can see from a more or less thorough acquaintance with both the rotary and the stationary aeroplane engine, the rotary motor will be the better for speed work and where the greatest possible load is to be carried. When several disadvantages of the rotary are overcome I think it will be the better motor for all classes of aeroplane work. In other words, I think a motor of the Gnome type will always be the lightest for the power developed. In this connection let me say that there is an opinion prevalent among aviators acquainted with both types that 50 horse-power from a rotary engine accomplished more in an aeroplane than 50 horse-power from an engine having stationary cylinders. This has been my experience, and I account for the difference in the superior flywheel effect in a rotary engine which is itself an unusually effective flywheel.

Summing up its disadvantages, the rotary motor of to-day is expensive to buy, very expensive in upkeep, and will not stand the rough usage which would have little effect upon the more orthodox engines having stationary cylinders. These disadvantages may be and probably will be overcome in the future, and then we shall have in the rotary gasoline engine the nearest thing to the ideal aeroplane motor.

Monsieur Seguin told me, when he showed me through his factory, that he was working on a two-cycle engine, and that he expected to realize one hundred and twenty horse-power with less weight than in my seventy. If a practical two-cycle rotary motor were evolved, it would be only one step removed from the motor which will undoubtedly be the aero engine of the future—the long-sought-for and much-talked-of gasoline turbine; and as an aviator who appreciates the great advantages of an ultra light but powerful motor, I hope to live to sit behind such an engine.

In America we have neglected the rotary type of aeroplane engine mainly for two reasons. First, it is very expensive to build and few factories have the shop equipment necessary to its successful construction. Second, it is not an easy motor to design. We are thoroughly acquainted with the engine having stationary cylinders from our automobile practice, but in the design of a rotary motor we enter a new and comparatively unexplored region. Several rotary engines are now being made in this country, and soon, no doubt, a thoroughly tested and reliable rotary engine aeroplane motor of Ameri-

can manufacture will be available. Realizing as I do, from practical experience in the air, the great advantage of the rotary aeroplane motor, I feel confident that it is the aero motor of the future, and I strongly advise American manufacturers, who have so far chosen to ignore it as a freak, to give the matter their earliest and careful consideration. The rotary motor has made remarkable headway against almost universal opposition until to-day the world's speed records, without a single exception, are held by a motor of this type.

The Race for the Harmsworth Cup

(Concluded from page [illegible].)

first circuit two seconds in the lead, making an average of forty-six miles an hour, the fastest ever accomplished by a motor boat in competition. "Maple Leaf IV" was thirty-two seconds behind.

At the finish of the second lap "Ankle Deep" led, followed by "Reliance II," two hundred and twenty yards ahead of the English boat. In the race to the outer turn for the third time "Ankle Deep" still led, but "Reliance II" had to stop before the turn was reached. The "Mona" burned out a bearing and had to give up. The contest lay between "Ankle Deep" and the other British boat, with the former three quarters of a mile to the good. "Ankle Deep" was visibly running away from "Maple Leaf IV," when suddenly it was seen that "Ankle Deep" had stopped and was gyrating. A few seconds more and it was all over. "Maple Leaf IV" came home an easy winner.

"Reliance II" had blown out two of her cylinders. When "Ankle Deep" was going forty-five miles an hour Count Mankowsky attempted to make too sharp a turn at the westerly mark. Her starboard propeller, strut and rudder were literally wrung from the hull into a twisted, shapeless mass. The "Maple Leaf IV," running as smoothly as a watch, covered the course in forty-seven minutes and forty-six seconds, or at an average speed of 43.125 miles per hour, rather better than "Baby Reliance II" did in the first race, but considerably less than the burst of speed shown by the same boat in the first circuit, and behind the rate at which "Ankle Deep" was speeding when she met with her mishap.

Everyone conceded that, barring accidents, the "Ankle Deep" was the fastest boat. It was also equally evident that the winning English boat was by far the most reliable of the five contestants. Reliability won the race and not speed.

This question of reliability did not lie wholly with the engines. From the point of view of mechanical excellence there was little to choose between the various types of motors used on the five boats. Under similar ordinary conditions there is every reason to believe that one would prove as reliable as another. The fault was not that the "Ankle Deep" or the "Reliances'" engines were not as good as the "Maple Leaf IV's," but that they were not as well installed. Impartial critics of the boats are of the opinion that had the installation of the motors been more thoroughly looked after the result would have been different. It is said, for instance, that one of the "Ankle Deep's" shafts was out of alignment and that this was known before she started, but that the defect was not considered of sufficient consequence to attempt to remedy in the short time that was available. It was also stated that the loss of the "Ankle Deep's" propeller, which cost America the race, was partly due to the use of too light bronze in her propeller shafts. At any rate, the sudden strain, added to the deviation from alignment, was too much for the metal, and it gave way. To sum up the mechanical side of the matter, the British boat was looked after more thoroughly, more carefully groomed, than any of the American craft.

Of course, so long as there are racing motor boats, each of the varying species of construction, shape of the hull, number of steps, and so on will have its advocates. There is little question, however, that the design of the "Ankle Deep" and of the "Reliance" boats is [illegible]

of either of the British craft. Therefore, in building the three new challengers, one of which it is hoped will lift the Harmsworth trophy next year, it is not likely that any wide departures will be made from the outlines that have been found so satisfactory.

One other essential lesson has been taught to the American builders by this race. It has been demonstrated that boats under thirty feet in length—the limit is forty feet in the Harmsworth deed of gift of the trophy—cannot hope to succeed except under exceptionally perfect conditions of the water. The "Maple Leaf IV" is thirty-nine feet eleven inches long, within one inch of the limit. The "Baby Reliance II" is but twenty feet long, and the "Ankle Deep" thirty-two. The British craft was more seaworthy, built to take both calm and rough water. The American craft, with some exception in favor of the "Ankle Deep," are wonders in the speed line under perfect weather conditions, but when the water grows rough they are almost helpless. This contest proves that America still has the fastest motor boats, but that the English are ahead of us in reliability. The new American challengers will have both speed and steadiness of hulls and engines, essential qualities if we are to recapture the Harmsworth Cup.

Our Enormous Coal Losses

"DURING the last year, in producing half a billion tons of coal we wasted or left underground, in such condition that it probably will not be recovered in the future, a quarter of a billion tons of coal; we turned loose into the atmosphere a quantity of natural gas larger than the total output of artificial gas during the same period in all the towns and cities of the United States; we also wasted or lost in the mining, preparation and treatment of other important metalliferous and non-metalliferous minerals from 10 to 50 per cent of the year's production of such minerals."

The above is the startling manner in which Dr. Joseph A. Holmes, director of the United States Bureau of Mines, describes some of the losses in the yearly production of two billion dollars worth of minerals in the United States

The words of the director are a general summing up of a statement just issued by the Bureau, in which an inventory of the various mineral wastes are given and in which the Bureau shows how millions and millions of dollars may be saved to the people of this country through the right sort of conservation of its resources

The general statement, written by Charles L. Parsons, chief mineral chemist of the Bureau, contains the charge that many valuable mineral deposits are lying idle, while the products are being imported from other countries Mr. Parsons further declares that through wasteful use of certain of the minerals, the ultimate exhaustion and dissipation of some of the important useful minerals of to-day from the standpoint of the race and in the light of present knowledge, is in sight. He urges that many deposits of ores of such low grade that they cannot be mined to-day should be left in position so that they can be mined in the future, as many ores, formerly of too low grade to work with profit, are now sources of wealth. The wastes of the past are daily being converted into the dividends of the present, he declares.

In referring to the waste in the mining and use of coal, Mr. Parsons says, "The wastes of carbon in our modern economy are almost incomprehensible. In mining coal in this country, probably one third of the bituminous coal and one half of the anthracite are left in the mine. Fully 80,000,000 tons of anthracite is now being left behind in the mine each year, and it is estimated that since mining began in this country fully two billion tons of anthracite and three billion tons of bituminous coal have been left in the ground under conditions which make future recovery highly impossible.

"After coal is mined the losses by no means cease, although some of the culm that formerly went to waste by millions

of tons is now being used. Probably not over eleven per cent of the energy in coal is being effectively utilized. The remainder of the energy is lost through the inefficiency of the steam boiler, the steam engine and the electric dynamo.

"It is estimated that the boiler scale in locomotives alone in this country means a loss of over 15,000,000 tons of coal annually. It has been shown that one sixteenth of an inch of scale means a loss of 25 per cent in boiler efficiency. The scientific control of the combustion of coal under boilers is constantly increasing, but the losses of carbon that is still pouring from our chimneys, defacing monuments, buildings and landscape are without valid reason."

Mr. Parsons says that the losses in making of coke by the old-fashioned process wasted $40,000,000 in the United States last year. He calls this an entirely needless and seemingly ruthless loss. He declares that these coke ovens, without taking into account the value of the by-products that were possible, wasted more than one million horse-power in the year. All this loss might be prevented by the use of modern methods, he says.

"The dust from stacks and chimneys of all kinds," says Mr. Parsons, "is often not only a great waste of valuable material, but is one of the great evils of modern civilization. Valuable metalliferous dusts are strewn broadcast from the stacks of our smelters; gases and poisonous solids destroy vegetable and animal life; and masses of black smoke pour from our chimneys and settle in clouds over many of our cities, rendering them exceedingly disagreeable and unsightly. Even with present knowledge, practically all dust nuisances are preventable, and legislation the country over is diminishing the dust output from smelters, cement plants, and from smoking chimneys, often with the result that the collection of dust incident to smoke prevention becomes a source of profit.

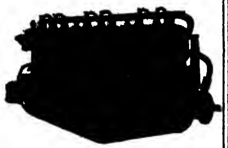
"Almost inestimable losses of sulphur, arsenic, and bismuth are now taking place in the flue dusts and flue gases.

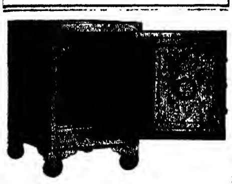
"In proportion to output the losses of zinc are probably greater than those of any other metal, and are especially important because there is almost no recovery of zinc from manufactured products and almost no conservation of zinc by accumulation. Besides these losses in the mining and concentration of zinc ores, there are incalculable losses, which without question run into many millions of dollars and undoubtedly exceed the total value of the zinc mined, in slags and waste products from other processes. Zinc has been and in general still is considered about the worst impurity to be found in the ores of copper and lead, for it has always given trouble in their metallurgy.

"In combined, but unfortunately in relatively insoluble form there are unlimited supplies of potash in this country. Because no methods are known for economically obtaining the potash we are obliged to import from Germany about $15,000,000 worth each year. Potash is absolutely essential, and unless methods can be found for obtaining it from domestic supplies, we shall be obliged to purchase it from Germany at a price at least 400 per cent more than the cost of delivery in New York.

"Our waste of nitrogen, worth in combined form about fifteen cents per pound, are almost inconceivable, and no calculation can give us a real idea of what these losses mean. Although we produced last year over 406,000,000 tons of bituminous coal, we recovered only $3,800,000 worth of the $160,000,000 worth of recoverable nitrogen in the coal.

"Of course, it is entirely impracticable under present conditions to recover as ammonia all of the nitrogen that might be obtained, but it does seem most regrettable that of 63,000,000 tons of coal converted into coke in 1910, containing $22,000,000 worth of recoverable nitrogen, only about one sixth was treated in ovens or retorts which could make that recovery possible. The rest of the nitrogen in the





coal went off as free nitrogen in the air. It is estimated that since the first by-product coke oven was built in this country in 1893, and up to the present time, the coke coked in the old-fashioned beehive ovens where the nitrogen was ruthlessly wasted in fire has amounted to about 810,000,000 tons. Had this been coked in by-product ovens the volatile nitrogen of the coal would have yielded twenty-three pounds of ammonium sulphate per ton or a total of 9,315,000 tons, which at $60 a ton would have had a value of $558,900,000. But this would not be all. Had this ammonia been recovered, it would have been used on the soil as a fertilizer and the crops would have increased fully 20 per cent, and the saving would have been many millions more.

"The waste and the utilization of sulphur are both enormous and depend largely on local conditions. We produce sulphur cheaper than any other country in the world, sell it at perhaps the highest price, and in the form of sulphur dioxide discharge it in the air from the stack of a single smelter in quantities almost as large as those utilized throughout the country from sulphur and domestic pyrite put together. If the sulphur discharged into the air from this one smelter were converted into sulphuric acid it would furnish more than enough sulphur acid for the total fertilizer industry of the United States. This country is producing annually about 3,000,000 tons of sulphuric acid—the basis of all chemical industry—of which approximately one half is used in the manufacture of fertilizers. The total amount of sulphur dioxide discharged into the air in the country would unquestionably suffice to make more than 8,000,000 tons of sulphuric acid."

The American Road Congress

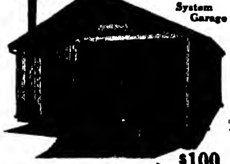
THAT not less than $250,000,000 would be saved to the country in the cost of hauling the present record breaking crop if 20 per cent of the public highways of the country were improved, is the assertion of J. E. Pennybacker, Jr., executive secretary of the American Road Congress, which is to be held in Atlantic City September 30th to October 5th. Mr. Pennybacker, before becoming the secretary of the American Association for Highway Improvement, which, with the American Automobile Association and the National Association of Machinery and Material Manufacturers is holding a convention at Atlantic City, was the chief of the Road Management Department in the United States Office of Public Roads, has made a comparative study of the cost of hauling crops over good and bad roads.

In an interview Mr. Pennybacker said that it will be merely a matter of a few years before 20 per cent of the public highways of the United States will have been improved. At the present time little over 8 per cent of the public highways are of the improved type.

"The Governments' prediction that the crop now being harvested will exceed any previous year's yield," said Mr. Pennybacker, "should serve to call attention to the great losses that are being sustained by farmers and consumers in the hauling of crops. It is estimated that the improvement of the main roads of this country, approximately 20 per cent, would result in an annual saving of at least $250,000,000 in the cost of hauling alone, which would be sufficient to improve 50,000 miles of road at a further cost of $5,000 per mile. In five years this would improve 250,000 miles, which would be sufficient to bring the total mileage of improved roads up to 20 per cent.

"There are more than 25,000,000 farm horses and mules in the United States, valued at $2,700,000,000; about 1,800,000 horse-drawn vehicles valued at $83,000,000, and more than 450,000 automobiles valued at about $500,000,000. A depreciation of 5 per cent, caused by the wear and tear of bad roads, would amount to $164,000,000 annually, which at $5,000 per mile would be sufficient to build 32,800 miles of improved roads.

"These are but a few great economic



facts. Once the people realize the great waste involved in bad roads, there will be little delay in the improvement of the main arteries of commerce throughout the country."

The Antiquity of the Raingage

WHEN and where was the raingage invented? The fact that the customary ascription of this invention to Benedetto Castelli, in the year 1639, is far indicating the real antiquity of the instrument was pointed out in the SCIENTIFIC AMERICAN of December 24th, 1910, p. 504. In the same connection it was noted that the great importance of rainfall in its relation to rice-growing led to the construction of raingages in Korea as early as the year 1442 A. D.; while a much earlier use of the instrument—in response to agricultural requirements in Palestine—described in the Mishna, carries the history of raingages back to the first century of the Christian era.

A further contribution to this subject is published in the *Quarterly Journal* of the Royal Meteorological Society for January, 1912. The writer, Jogindra Nath Sammadar, quotes some pertinent information from a book entitled "Arthastra," or "The Science of Polities," written by Chanakya, the famous minister of Chandragupta, the founder of the Maurya dynasty in India, and dating from the fourth century B. C.

In the chapter on the "Superintendent of Agriculture" this early work states:

"The quantity of rain that falls in the country of Jangala is 16 *dronas*, half as much more in Anupanam countries; 13½ *dronas* in the country of Asmakas (Southern India), 23 *dronas* in Avanti (Konkan); and an immense quantity in Apparantam (western countries), the borders of the Himalayas, and the countries where water-channels are made use of in agriculture. When one-third of the requisite quantity of rain falls both during the commencement and closing months of the rainy season, and two-thirds in the middle, then the rainfall is considered very even."

These explicit statements certainly point to the fact that some form of raingage was known in India as early as the fourth century B. C. As to the *drona*, the writer only tells us that it was "a cubic measure;" hence, even if we knew its value, we should need also to know the surface area of the raingage in order to interpret the statistics given above, whereas modern statistics of rainfall, in linear measure, are independent of the dimensions of the gage.

Another passage in the same work seems to indicate that ancient Indian meteorology used a classification of cloud forms much more elaborate than any we have to-day:

"Three are the clouds that continuously rain for seven days, 80 are they that pour minute drops; and 60 are they that appear with the sunshine."

Announcement

WE beg to announce a new department of the SCIENTIFIC AMERICAN, devoted to the interests of present and prospective owners of motor-driven commercial vehicles.

The department will contain:

Discussions of Live Topics.

Real Experiences of Motor Truck Owners, showing how the power vehicle works out in actual practice in various lines of commercial service.

Obstacles overcome and economies effected by the introduction of the gasoline and electric horse.

Up-to-date information on the latest improvements in auto trucks and delivery wagons.

Advice on the care and upkeep of motor vehicles.

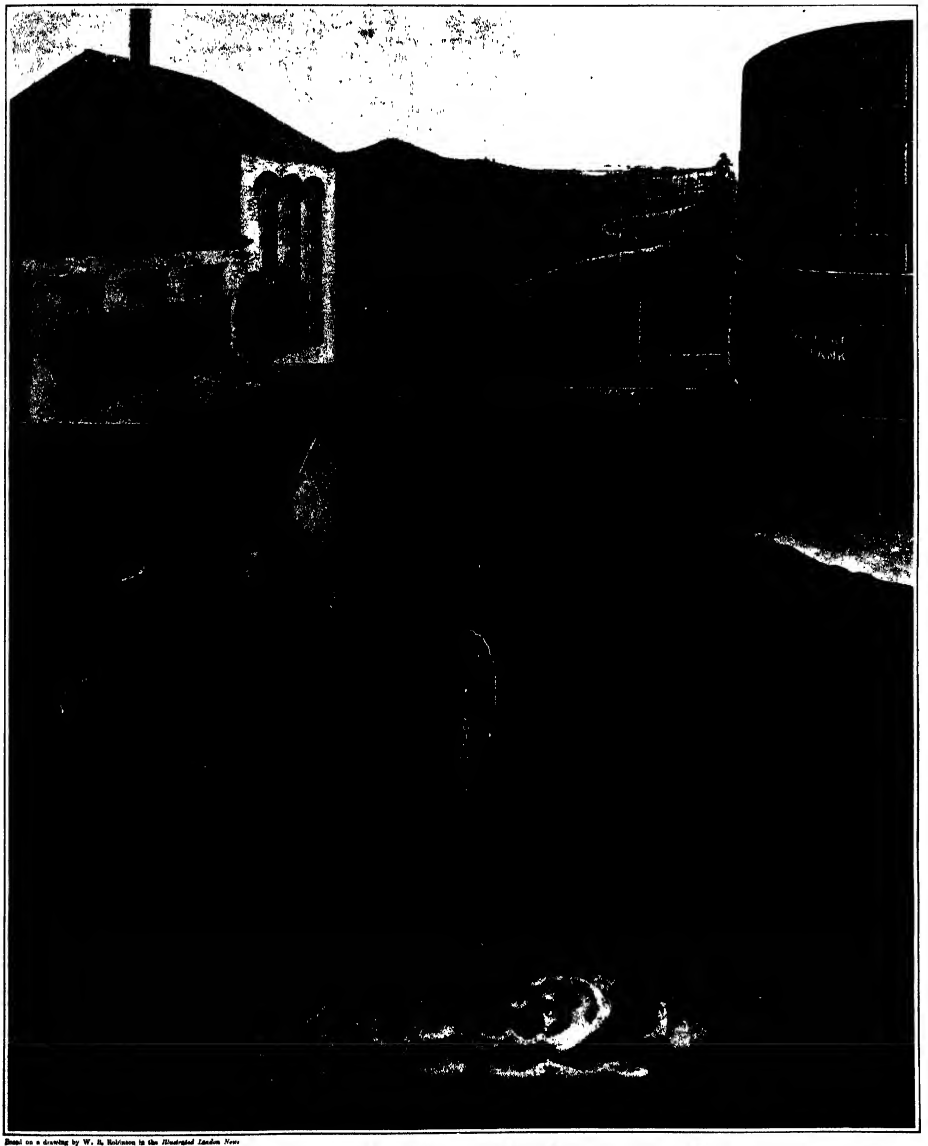
In connection with this Department an Information Bureau will be conducted, in which the Editor offers unbiased advice to those who are concerned with motor transportation, and will endeavor to answer as completely as possible any questions that may be put to him relating to mechanical features, operation and management of commercial motor vehicles. The first issue of this Department will appear in the SCIENTIFIC AMERICAN of September 21st.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 12 | NEW YORK, SEPTEMBER 21, 1912 | 10 CENTS A COPY $3.00 A YEAR



Based on a drawing by W. B. Robinson in the *Illustrated London News*

Sir William Ramsay believes it will be possible to burn coal in the depths of the earth to produce gas conveyed by pipe to engines in a power house on the surface.

"Bring your gas engines to the mouth of your pit or bore-hole and produce your power there," urges Sir William. "You would thus have 30 per cent of the energy of the coal available as against 15 per cent available in fuel engines."—[See page 241.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, SEPTEMBER 21, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid.	4.50
Subscriptions for Canada, one year, postage prepaid.	3.75

The Scientific American Publications

Scientific American (established 1845)	per year.	$3.00
Scientific American Supplement (established 1876)	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Promise Unfulfilled

THE failure of America to send a single machine across the line in defense of the Gordon Bennett Cup, proves that in spite of the brilliant work which has been done by individual Americans in promoting the art of aviation, as a nation we are lagging deplorably in the rear. When the winning French machine swept in faultless style over the course at Chicago, with not a single American entrant in the air to dispute its victory, the thoughts of some of the spectators must surely have gone back to that memorable day among the sand dunes of Kitty Hawk, when an American mechanic left the ground in a power-driven machine, and achieved the seemingly impossible by making a clean-cut flight of one half a mile through the air.

In some future age when aviation shall have been established as one of the accepted means of transportation, when the problems of starting, alighting and automatic stability have been fully solved and travel through the air shall have become as safe if not safer than travel by rail or sea, the man who sits down to write the story of the development of high-speed transportation, with its long record of brilliant achievements, will undoubtedly place at the head of the list that first successful essay of the late and ever-to-be-lamented Wilbur Wright.

Without casting the least reflection upon the admirable work done by European experimentalists, it can be truthfully said that the work of Chanute, Langley, and the Wright brothers has established beyond all disputation the right of America to be named as the birthplace of the most difficult mechanical feat ever attempted by man.

Having made such a notable start, America, by all reasonable expectation, should have continued to lead the world in the development of the new art. We are an ambitious and strongly competitive people; highly inventive, possessed of an inborn mechanical genius; and abundantly equipped both with facilities for laboratory experiments and with the necessary capital for development. Nevertheless, it is a lamentable fact that pre-eminence, both in the construction and flying of aeroplanes, passed at an early stage to Europe, where it has ever since remained. How far we have failed to fulfill our first great promise is shown by the recent fiasco of our attempt to defend the world's greatest aviation trophy.

Simple justice calls our attention to the fact that the present situation is due to causes national rather than individual. The two indispensable aids to development after the first start had been made, namely, governmental encouragement and the assistance of capital, have both been markedly absent. A certain amount of Federal aid has been extended, it is true; but in view of what is being done abroad, it must be admitted that it has been pitifully small. As for the advancement of capital, all that can be said is that if the financiers had shown one tenth of the enthusiasm and courage which have been manifested by individual inventors and experimentalists, we could easily have maintained the proud position which was won for us by the patience and zeal of the Wright brothers.

Furthermore, outside of those highly-to-be-commended individuals who have not hesitated to embark their time, labor and all too-slender means in the development of the aeroplane, there has been a strange lack of public interest in the subject. Beyond going in some numbers to witness the spectacular feats of a few airmen at the aviation meets, we seem, as a people, to have been perfectly content to mark time and watch the European nations turn to practical and national advantage what we have so well begun.

The insignificant position now held by the United States in practical aviation was strikingly shown by the Hon. William G. Sharp, in a recent speech before the House of Representatives:

"If I were to use a blackboard at the front of the clerk's desk and illustrate in another manner the relative extent of our development as compared with that of other countries in this most important work, I could draw a line at least 3 feet in length to represent the position of France, and then away down at the bottom, after such countries as Austria and Italy, I would have to draw one, not exceeding an inch in length, representing its growth in the United States. Or, if I were pictorially inclined and wished to draw upon that blackboard a modern aeroplane and give to it a width of plane of 3 feet, representing the aeroplane strength of France, taking up almost the entire size of the blackboard, I could fairly represent the relative position of the United States Government by pinning upon it one of the smallest butterflies that you may see playing about the Capitol grounds.

"Perhaps a better way of putting it in a dollars-and-cents aspect would be to say that we appropriated, as you gentlemen remember, in a bill reported out of the Committee on Military Affairs, $75,000 for the construction of aeroplanes for the Army for the ensuing year. For a like period France contributed over $4,000,000. Germany came a close second; and then England, Italy, Austria, Russia, and one or two others of the smaller powers."

Our lack of practical interest in aviation may be explained on several grounds. The slight degree of assistance rendered so tardily by our Government may have been due to an over-developed conservatism; the failure of capital to interest itself may have been due, to a conviction that the time had not arrived when investment would give any reasonable prospects of profitable returns. But the failure of the public at large to interest itself greatly in aviation as a sport is perplexing. We are strongly imbued as a people with that competitive instinct which is essential to the development of sport. We follow the fortunes of our athletes at an Olympiad with the keenest interest and turn out *en masse* to welcome them on their victorious return. We squander millions in the defense of a yachting trophy, and spend hours in watching a couple of yachts contest in slight and drifting winds for an international cup; but when it comes to the defense of a trophy which represents the highest achievement in an art whose genesis was due to our own perseverance and ingenuity, we stand supinely by and allow the prize to be snatched from our midst without making any adequate effort to defend it.

Perhaps some of the readers of the SCIENTIFIC AMERICAN can offer an explanation of this anomaly. We shall be pleased to throw our correspondence columns open for a discussion of the subject.

The Steel Rail

IF we were asked to name the one product of the foundry and rail mill which is called upon, in its daily service, to perform the most exacting and destructive duty, we should select offhand the steel rail, and particularly the American steel rail—for it is certain that in no country of the world is this overworked member subjected to such violent usage. Acting as a bridge to carry the wheel loads from tie to tie, it must endure bending stresses such as no engineer would dream of imposing upon a plate girder or a truss bridge. A reversion of stress in any member is notoriously trying and destructive; yet the steel rail (especially if the track is not in first-class condition) is subjected to reverse stresses of the heaviest character. So complicated are the forces which act upon the rail, that their exact analysis would defy all the skill and apparatus of the most complete testing laboratory in the world. Stresses of compression, tension and torsion follow each other in swift succession, and they are frequently acting at the same time and in large quantities in any given length of rail. Finally, as if this were not sufficient, the rail itself is treated as an anvil and subjected to a fierce pounding whose hammer blow is often sufficient to flatten it down, if indeed it does not break it clean in two.

Now, one would expect that a member which is to be subjected to such severe uses, upon which is imposed such exacting duty, would receive every assistance (that careful selection of the materials of its composition), and patient carrying out of the processes of manufacture, could afford. But unfortunately the demand for steel rails is so enormous, and often so very urgent, that there has been a strong temptation for the manufacturer to sacrifice quality to output. Processes for which, if the product is to be reliable, time and patience are an absolute necessity, have been "speeded up." The result has been a rate of manufacture and a magnitude of output that are one of the wonders of modern industry. But there has been another result just as marked, and that has been the depreciation in the wearing quality, strength and general reliability of the rail.

The recent meeting of the International Institution for the Testing of Material has shown how fully these facts are realized and how earnestly engineers the world over are seeking for the proper remedy—the reasonable compromise. Reliable rails can be produced for a reasonable price to the railroad, and at a reasonable profit to the rail mills. In an early issue we expect to publish further letters in addition to those which have appeared on this subject, and shall enter into a more complete discussion on the causes and remedies for the present conditions.

The Atlantic Inland Water Route

IF we do not hear so much in these days about the military advantages of the proposed Inland Water Route along the Atlantic Coast, it is not because those advantages are any less real, or any less, than they were some years ago, but rather because the great commercial advantages of the scheme are becoming increasingly evident.

In the event of the blockade of the Atlantic and Gulf ports and harbors by a superior force of the enemy, there can be no question that the existence of an interior water route, linking together the blockaded points and putting them in water communication with one another, would have an important bearing upon the situation. The waterways, which would generally be far enough inland to be removed from attack by the enemy, would make it possible to concentrate a powerful fleet of destroyers and submarines at any selected point on our coast line, and the concentration could be made with such absolute secrecy that the enemy would be in ignorance of the point at which the attack was planned and could make no special provisions to meet it.

It is as a commercial proposition, however, that the proposed waterways call most strongly for recognition and support. Not only will the transport of freight, because of the sheltered character of the route, be accomplished with greater safety, but there will be an inevitable and considerable lowering of transportation rates as compared with those that obtain over the present routes by rail.

In his recent address before the Atlantic Deeper Waterways Convention, Mr. Acker, the president of the Philadelphia Chamber of Commerce, pointed out that the new route will enable manufacturers in New England to procure their coal and their cotton from the South and send their manufactured products to New York, Philadelphia, Baltimore, and other important points along the proposed route at lower through rates than at present. Furthermore, the claim is well made by the advocates of this scheme that its completion will surely stimulate the interchange of commodities along the whole line of the proposed route. Centers that are now separated by geographical conditions which render the interchange of trade difficult and unprofitable will be provided with the cheapest known method of transportation; and it is perfectly reasonable to believe that the towns and cities contiguous to or within easy reach of the waterways will be commercially greatly benefited.

We heartily agree with Mr. Acker that there is no necessary antagonism between rail and water transportation interests. On the contrary, if they are properly regulated they are complementary to each other. With intelligent regulation, heavy freight in bulk will be carried by water and the lighter and fast freight by rail.

An Automobile Repair Shop for Aeroplanes

AN automobile of somewhat curious design is being put in use for the aeroplane service in the French army, and it forms a veritable machine shop for making all the needed repairs upon aeroplanes. No doubt it will prove valuable from the fact that it can be quickly brought to the spot where an aeroplane in a disabled condition may require its help. It has the shape of a large covered power wagon with motor and driver's seat in front. An electric transmission is used on the car. The inside space gives room for a number of tools such as a lathe and an emery grinder, both driven by electric motors, also a portable forge and carpenter's and machinist's benches with tools. Aeroplane pieces can be readily repaired and even new pieces made. Electric lighting is used throughout the car.

Engineering

Naval Skeleton Mast Under Fire.—It is unofficially reported that the skeleton mast which was erected on the old "San Marcos" to test its resistance to gun fire, stood up remarkably well under bombardment by large guns and more than fulfilled the theories on which it was built. We hope to give official particulars at a later date.

Latest German Battle Cruiser.—The latest German battle cruiser "Goeben," during her recent forced-draught trial, maintained for several hours a speed of 28.40 knots. This vessel is a sister ship to the "Moltke" which recently visited this country. The "Moltke," since her going into commission, has made slightly over 29 knots; therefore it is reasonable to suppose that when her machinery is shaken down the "Goeben" will equal that record.

Russian Head of Material Testing Association.—The Sixth Triennial Congress of the International Association for Testing Materials, before adjourning, elected as its new international president, N. Belelubsky of St. Petersburg, who is the professor emeritus of the Institute of Engineers of Ways of Communication of the Emperor Alexander I. The Congress decided in honor of the Russian scientist to hold its next international conference in St. Petersburg in 1915.

Columbia University Research Department.—In connection with the recent gathering of the Association for Testing Materials it was announced that a large gift had been made by Edward W. Browning for a research department, which will establish testing laboratories similar to those maintained so successfully by the German government, whose scope of work will take in anything from a sheet of writing paper to the material for a modern gun. This is good news which will be welcomed by every practical scientist and engineer throughout the country.

Auxiliary Sailing Schooners.—Mr. George Westinghouse is strongly of the opinion that the typical American sailing schooner of many masts has a great future before it in the ocean-carrying trade, provided that it is equipped with auxiliaries. He believes that the best auxiliary will be a 750 horse-power turbine provided with reduction gear, such a plant being suitable to a 5-masted schooner of 5,000 tons. He believes an average speed of eight knots is practicable and that the economy would be such that these vessels would excel the typical tramp steamer as an economical freight carrier.

The "Half Moon" in the Hudson.—Those of us who are interested in historical relics will be glad to learn that the "Half Moon," which was presented to this country by Holland during the Hudson-Fulton celebration, has been given a permanent anchorage opposite Yonkers in the Hudson River. The little craft has been thoroughly overhauled and put in first-class condition; and it is sincerely to be hoped that this most interesting vessel will continue to receive the constant care which its intrinsic value as a faithful replica of Hudson's ship and as a gift from a friendly government, demands.

Reclaiming the Jersey Meadows.—The members of the American Peat Society, which recently held its annual convention in this city, visited the Jersey meadows where they inspected several hundred acres of peat bog that are being reclaimed and cultivated. After eight years of development some two hundred acres are yielding, in lettuce and onions, from 600 to 1,000 bushels per acre, while the yield of celery is said to average about 3,000 dozen per acre. The results obtained in this locality should prove a great stimulus in similar work of reclamation on valuable but undeveloped bog lands throughout the country.

To Safeguard Life and Limb.—The Allegemeine Electricitaets Gesellschaft of Berlin has cabled President Arthur Williams of the American Museum of Safety, that the Rathenau Gold Medal has been placed at the disposal of the Museum, for award annually for the best device or process for safeguarding life and limb or promoting health in the electrical industry. The competition is open to every country in the world, but the device or process must be exhibited at the American Museum of Safety in New York city. We congratulate the American Museum upon this distinct European recognition of the very good work it is doing.

Automatically Recording Sea Temperatures.—The superintendent of the Johns Hopkins Botanical Gardens, William H. Witte, has given to the public his ingenious plan for automatically recording changes in sea temperature when a ship is passing through the ice fields. Water flows through a small tank in the bow of the vessel, in which three distinct appliances serve to record the changes of temperature. These include a high and low thermometer, a copper plate whose lengthening or shortening operates a lever and records the changes of temperature on a revolving drum, and series of tubes filled with alcohol, the tubes being connected by a small alcohol-filled pipe with a diaphragm, which through a lever and a pen also records the changes of temperature on a drum. All records may be read in the pilot house.

Electricity

Electro-hydraulic Steering Gear for Vessels.—The general utilization of the electric light on board large vessels invites the replacing of steam steering gear by an electric motor-driven gear. In an electric gear recently developed an intermediate system of hydraulic cylinders protects the motor from the mechanical shock of waves upon the rudder. The motor runs continuously, driving a special pump the flow of which can be instantly stopped by the steersman or directed to either of the two hydraulic cylinders operating the rudder.

Aluminium Conductors in Winter.—One of the arguments directed against the use of aluminium for transmission lines is that, in winter time, they will collect a thicker coating of ice and snow because of their large diameter and, hence, will sag more than the copper wire of equal carrying capacity. A writer in *Elektrotechnische Zeitung* believes that this contention is based on a fallacy. He has found that in Norway the copper telephone wires of 4 millimeters (0.16-inch) diameter become just as thickly coated as the aluminium cables of 300 square millimeters (0.46 square inch) section.

Freeing the Hands in Telephoning.—In using the telephone one's hands are tied by the necessity of holding the receiver to the ear by the left hand and by the habit of picking up the ordinary desk telephone set in the other hand. A British inventor has devised a simple arrangement for freeing both hands and thereby saving time. In "holding the line" one places the receiver on a platform which presses the earpiece against the small end of a sound-magnifying trumpet. The trumpet—not unlike a flattened motor-car horn in shape—talks out into the air, enabling one to hear while leaving both hands free for looking up references or filling the waiting time in any other way.

Electric Miners' Lamps.—A recent English government competition for the best electric lantern suitable for miners' use has brought out several creditable lanterns designed to meet the rather difficult specifications imposed. One of the prize-winning lanterns is so well constructed and so completely gas-tight (to avoid all risk of igniting firedamp in the mine by an electric spark at the switch) that the lantern may be used under water if necessary. All contacts are made inside the case. Careful construction of the lantern as a whole and of the single storage cell which furnishes the current for the 2 candle-power lamp gives a weight of only 3½ pounds, the same weight as an ordinary miners' oil-burning "safety" lantern.

A Powerful High-tension Electrostatic Machine.—A large 20-disk influence machine capable of generating potential differences up to 320,000 volts has been built in Paris for experimental work on high direct-current potentials. This machine is designed for strength, permanently good insulation and freedom from vibration in running, and in appearance savors of the commercial rather than of the experimental. The ten pairs of ebonite disks, 73 centimeters in diameter, are rotated in opposite directions at 1,500 revolutions per minute by individual belts from an electric motor-driven main shaft. Any disk may be withdrawn very readily for the inspection and cleaning necessary to keep the machine in working order to give its maximum output.

Diffusing Bulb for Tungsten Lamps.—Owing to the extreme brilliancy of the incandescent tungsten filament, various methods have been tried to diffuse the light either by frosting the bulb or by using a shade or globe. Such means, however, have the defect of absorbing a large proportion of the light. A patent has been recently granted to Mr. Peter Cooper Hewitt on a lamp bulb formed with parallel longitudinal grooves in the outer surface. The lamp is thus formed into a myriad of long narrow prisms which diffuse the light so that the entire bulb seems to be aglow. The light of the filament being spread over a large surface is not so painful to the eye. At the same time practically none of the light is lost as in the case of the frosted bulb. The lamp bulb is grooved by etching the glass with hydrofluoric acid.

Conductive Ink.—Two patents were recently granted on ink which is electrically conductive when dry. The inventor, Mr. H. E. Goldberg of Chicago, has discovered that metals in the colloidal form in a volatile liquid may be used as ink, and that when spread upon the surface and the volatile element has evaporated, there is left a metallic layer which is continuous and electrically conductive. Many metals such as silver, gold, platinum and copper, also graphite, may be rendered colloidal by forming a direct current arc under water between terminals consisting of the metals. The metal is so finely divided as not to precipitate under the action of gravity from the liquid in which it is diffused. The various metals produce different colored inks. Silver colloid will produce gold colored marks or even grass green. Colloidal graphite produces black or grayish black marks, but is not as electrically conductive. By combining silver and graphite an ink is obtained which is substantially black and has good conductivity.

Science

Prof. Francois Alphonse Forel died at Morges, August 7th, at the age of 71 years. To the world at large he was best known as an authority on the Swiss lakes—especially Lake Geneva—but his investigations embraced a wide range of subjects in physiology, zoology and geology.

Coffee Without Caffein.—The American consul at Tamatave, Madagascar, has sent to the Bureau of Manufactures in Washington samples and photographs of a natural caffein-less coffee growing in that island. It is locally known as "mantaska" or "café sauvage," grows to a height of 12 to 20 feet, and resembles the ordinary coffee tree, but has smaller leaves and a yellowish berry.

Black Opals are commonly the result of artificial coloring, but true black opals have been mined in a small district at the head of the River Darling in northern New South Wales during the past nine years. The output was at first very small, but for a few years amounted to 30,000 to 40,000 per annum. At present, according to a consular report from Adelaide, they have become extremely rare, hardly any having been found during the last nine months.

The Brahmaputra Expedition, recently undertaken by the British authorities in India to punish the Abor tribesmen for the murder of Commissioner Williamson, has not yielded all the geographical information that was hoped for, as it was not found possible to explore all the unknown portion of the Brahmaputra-Tsangpo. However, a total of 35 square miles was surveyed, materially reducing the unexplored part of this territory, and much other scientific work was accomplished. Incidentally, the attempt to chastise the Abors was a failure.

The Royal Geographical Society, generally recognized as the foremost organization of its kind in the world, is about to emerge from the crepuscular purlieus of Savile Row, and take possession of a fine residence facing Hyde Park. The Society has bought Lowther Lodge, with two acres of grounds, having frontages to Prince's Gate and Kensington Gore. Here it will have most of the accommodations of a first-rate club, and room for the growth of its splendid library, map rooms, etc.

Dust from the Tail of Halley's Comet, according to M. Marchand, of the Pic du Midi Observatory, is responsible for the coronas that have frequently been seen around the moon in perfectly clear weather ever since May 19th, 1911. It is well known that the angular size of a corona depends upon the size of the solid or liquid particles in the air which diffract the light, the smaller these particles, the larger the corona. M. Marchand's measurements indicated an average diameter for the dust particles of from 20 to 30 microns shortly after the passage of the comet's tail through our atmosphere. Since that time the size of the particles has decreased to about 0.5 micron.

Easter Island, lying 2,000 miles west of the South American coast, in the South Pacific Ocean, has been, ever since its discovery by Europeans, a most interesting archæological puzzle on account of its colossal stone statues, ruined stone houses, and other remains of an unknown race. *Petermanns Mitteilungen* reports that a fresh attempt to solve the mystery of these remains has been undertaken by an English sportsman, W. Scoresby Routledge, who is proceeding to the island on a motor yacht, accompanied by a geologist and an archæologist from the British Museum.

Topographic Maps of Counties.—The well-known Topographic Atlas sheets of the U. S. Geological Survey, which will ultimately cover the whole of the United States, divide the country into regular "quadrangles" having no relation to political boundaries. As there is, however, a demand for county maps of the same general character, the Survey has begun experimentally to issue such maps. The first of the series, recently published, is of Jefferson County, Kentucky. The area was surveyed in co-operation with the Geological Survey of Kentucky. The county is very irregular in shape, and includes parts of the areas shown on six "quadrangle" sheets of the Topographic Atlas.

Magnesia Rods as a Substitute for Platinum Wire in the Chemical Laboratory.—The increase in the cost of platinum has forced the chemist to look for a cheaper substitute. E. Wedekind, in *Berichte der Deutschen Chemischen Gesellschaft*, points to the fact that the magnesia rods used by the manufacturers to support incandescent mantles may be used for many purposes in the laboratory where platinum wire is used and others where the latter can not be employed. These rods are made of a magnesia composition, having great resistance to heat, and have a length of 15 cm. (6 inches) and a width of 1 mm. (0.04 inch). For use, these rods are fastened to a cork, which fits in a test tube. They can thus be kept for an indefinite period and are always ready for use. They are especially valuable for flame tests, borax and phosphate pearls, fusing, evaporating of volatile substances, and other demonstration purposes.

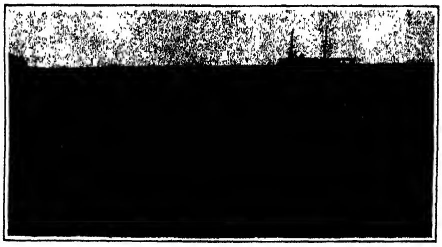
The Mile-a-Minute Boat

IT seems the irony of fate that we should have had to relinquish the Harmsworth trophy for the speediest boat of the year just two days before one of our own boats established a world's record for speed, raising that record close to the mile-a-minute mark. However, even had the "Tech, Jr.," been able to compete in the international contest, it is not at all certain that she would have won the trophy for the reason that it was reliability rather than speed that gave the cup to the "Maple Leaf IV." Her best speed was exceeded by other boats which, however, failed to maintain their good showing throughout the races.

The "Tech, Jr.," owned by Col. T. Coleman du Pont, is a small hydroplane, 20 feet long, equipped with a 50 horse-power engine. In the contest for the Bosch trophy for the world's one-mile championship, held on Friday, September 6th, she made the first nautical mile in 1 minute 11 1/5 seconds. This is equivalent to 50.56 knots or 58.23 statute miles per hour. This was the best mile made by the boat, and the record was made on a rougher sea than was encountered during the race. The time for the other five miles was, respectively, 2:08 1/5, 1:40 1/5, 1:36 4/5, 1:31 3/5, and 2:38 4/5, making an average of 33.39 knots, or 38.46 statute miles per hour. Her speed thus fell to a low figure over a longer distance.

The other contestant of the trophy was the "Baby Reliance III," whose best mile was done in 1:24, or 42.45 knots, and her average was 30.98 knots, or 35.68 statute miles.

Our photograph shows the "Tech, Jr.," being driven at full speed over the course. Her planes have raised the fore part of the hull clear of the water, showing the rudder, which is placed well forward, lifted well above the water.



Running over the water at 58 miles per hour.

Light Made Audible

By P. F. Mottelay (London)

THE interest which was widely displayed in Mr. Fournier d'Albe's new invention at the time the original model was first submitted to members of the Royal Society in London, some months ago, has been intensified by the exhibition recently made of the improved apparatus at the optical convention in South Kensington.

The new apparatus actually enables the totally blind, among other results, to locate accurately any window or open bright light, to discover readily the shadows of objects passing between them and the light, to discover variations in light such as are produced by clouds passing over the sun, and to locate brightly illuminated objects, such as, for instance, people dressed in white.

The action of the instrument is based upon the peculiar property of selenium of changing its electrical conductivity under the influence of light. This property is utilized for producing an electric current, which is interrupted by a special clockwork interrupter, and so made audible in a telephone. Thus the eye is replaced by the ear as a detector of light.

The improved instrument is a differential one, and as shown in accompanying diagram, contains two sensitive selenium surfaces, which form two of the resistances. It is specially designed to indicate contrasts, and is, therefore, best adapted for discovering objects, independently of the intensity of the light, though the brightest light naturally gives the quickest and most certain indications.

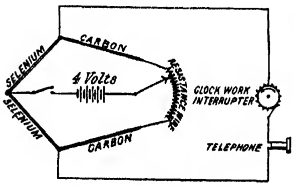
It consists of the camera-like box, ten inches long, three inches wide and four inches deep. To work it, it is necessary only to attach the telephone to one ear by means of the head-band, which latter should be slipped over the top of the head so as to hold firmly and enable the hands to remain free. The clockwork is then wound up by means of a small handle and a rod is moved along the slit until a purring sound is heard in the telephone. When this is the case, the iris diaphragm is closed down to its smallest size and the optophone is pointed (as one would a camera) toward some region of the open sky—though not to the sun, of course. The rod which controls the wire resistance should thereupon be moved until the purring becomes as faint as possible; should, however, absolute silence not be obtained in this way, the sliding lid must be opened and the carbon resistance adjusted until perfect silence is procured. The instrument is now in its most sensitive state. The passage of the hand or other object across the aperture is indicated by a purring sound, the loudest sound indicating the passage of the edges, where the contrast is greatest. The full effect takes a few seconds to develop, and slow movements are, therefore, more easily discovered than rapid ones. In a bright light, however, even the swiftest shadow is discoverable. Prolonged exposure to a bright light "blinds" the optophone just as it blinds the human eye, and some repose is required to let it regain its sensitiveness for faint light. In feeble light, the iris diaphragm should be open to its widest extent. A gentleman who tried the optophone found that a glimpse out of the window sounded like a cinematograph reeling off a film. The ticking sank almost into silence as the receiving tube was held in the shadow of the table, and leaped into a lively rattle when placed against an electric light bulb.

If you are blindfolded and place the receivers to your ears, and a piece of blotting paper is placed between the box and an incandescent lamp, you hear a ticking or grating sound; in fact, you hear the shadow passing.

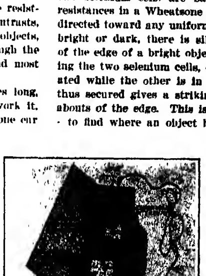
On a moonlight night you hear the moon, while the summer sun makes a tremendous noise like a cataract.

The optophone can locate the light of stars invisible through the telescope.

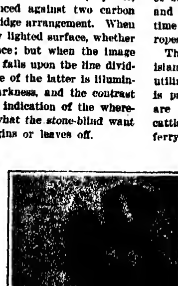
The telephones used are similar to those employed for wireless telegraphy, and are capable of detecting a current of a quarter of a micro-ampere when interrupted by clockwork. The carbon resistances are 1,000 to 2,000 ohms each. In the new differential optophone, two selenium cells are balanced against two carbon resistances in a Wheatstone bridge arrangement. When directed toward any uniformly lighted surface, whether bright or dark, there is silence; but when the image of the edge of a bright object falls upon the line dividing the two selenium cells, one of the latter is illuminated while the other is in darkness, and the contrast thus secured gives a striking indication of the whereabouts of the edge. This is what the stone-blind want to find where an object begins or leaves off.



Principle of the optophone.



Interior of the optophone, showing arrangement of parts.



Mr. E. Fournier d'Albe with his optophone.

The Mahagua Tree as a Source of Fiber

THE mallow family (*Malvaceae*) to which the common cotton plant belongs, includes a large number of trees and shrubs yielding valuable bast fiber. Mahagua or mahoe (*Paritium tiliaceum* Ad. Juss.) is perhaps the most important member of this group. All the species of the genus *Paritium*, of which there are over twenty, yield fiber, for cordage and other purposes. While all of them produce a valuable fiber the majority are of local use only, and the mahagua is the only one that is available in sufficient quantities to be worthy of the attention of the large trade. It furnishes a strong and flexible fiber comparable to jute, and has the remarkable quality of becoming stronger by long maceration in water.

The mahagua is a shrub or sometimes a rather large tree widely distributed, and is very common in all tropical countries, where it has been planted and escaped and now grows wild. It is a native of the West Indies and grows abundantly there. The tree was introduced into India very early and now is common on the Malabar coast, and is called *bola* by the Bengalese. It is also common both in East and West Africa, where it is cultivated in a good many gardens, because it is regarded as a very desirable shade tree. It is believed to have been cultivated for its fiber in tropical America before Columbus discovered the Western Continent.

Considerable quantities of this fiber have lately been exported from parts of India to England and the United States, where its use is constantly increasing. In India it has long been used to adulterate jute and hemp, which it resembles, and has been imported into France for use in the manufacture of high-grade paper. The fiber is white or grayish yellow, fine, silky, strong, pliant, slightly lustrous and somewhat lignified. The average length of the fiber is about five millimeters and about 16 micra in diameter. The walls are strongly thickened and the cell cavities are very small. According to Roxburgh the breaking strength is greater than that of the fibers of a majority of other textile plants. The mahagua fiber possesses unusual durability, which is a point of great importance. It is readily separated and the work of preparing it is less tedious than applies to the other fiber-yielding plants of this genus. It is well adapted for making rope, twine, sacking, mats, and is highly suitable for the paper trade and immense quantities of it might be gathered and brought into the United States. The bark is sometimes called Cuban-bast, and at one time was used for tying bundles of the genuine Havana cigars, but afterward imported as a substitute for the Russian bast used by the gardeners for tying up plants. It has also been used in making cigarette wrappers, and it is employed in many regions for making fishing nets.

In Nicaragua and in many other parts of Central America mahagua fiber is very abundant. It is used by the native store-keeper of the interior, instead of twine. The Indians and the native ranchmen use it for making lassos, halters, and ropes and wherever strength and durability are required. The majority of boatmen depend upon it for making their tie-lines and anchor ropes. The only expense incurred is the time required for making the ropes, while imported ropes are too expensive for the average boatman to buy.

The mahagua is found also on all the principal islands of the South Sea. In Guam the inhabitants utilize it also for making rope. Nearly every family is provided with rope-making appliances. The ropes are used chiefly for halters and lines for tethering cattle and caraboes, for harnesses and for cables for ferrying rafts across streams. The strength and durability of the ropes are much increased by tarring. The natives of the Caroline Islands split the inner bark into narrow strips, which they weave into breech-cloths or aprons worn by the women. In the Fiji Islands the bark is prepared by steeping it in water to render it soft and pliable. It is then made into women's "liku," a dress consisting of a number of fringes attached to a waist band.

Heated Steering Wheels

EVERY motorist knows how uncomfortable his hands are in a biting blizzard, or even on a still, but very cold day. To make life more agreeable an inventive genius has patented a hollow steering wheel, into which exhaust gases from the motor are conducted by means of a small pipe running parallel to the steering column. In the case of electrics, the hollow rim is filled with electric "heaters."

Sir William Ramsay in his laboratory.

Sir William believes it will be feasible to generate gas directly in mines that can no longer be worked profitably

Gas-Power Direct from the Coal Pit

An Interview With Sir William Ramsay

By Paul F. Mottelay, London

AT the recent Smoke Abatement Exhibition at Agricultural Hall, London, Sir William Ramsay made the first public reference to his projected power scheme. If, as many believe, his views can be effectively carried out, coal miners will find their services are no longer needed, or at least the demand for them will be much reduced.

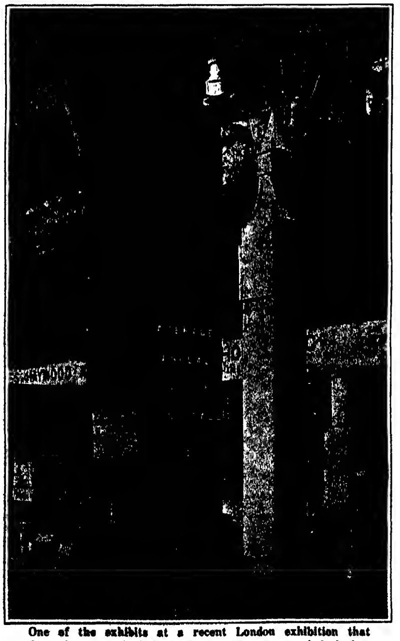
Sir William remarked that he had for many years been working with gases of all descriptions, in large and small quantities, and had managed to deal with such a very small portion that it would not fill one half a hollowed needle. There is, he says, nothing so easily managed as a gas. Although it cannot be seen, its presence is always evident it can be made to stream through a pipe at any desired rate and, when received, it can be handled as required.

Knowing that in the mining of salt, water is put down to the rock-salt where it remains until the rock is dissolved, when it is pumped up in the form of brine, he thought that possibly the simplest way to secure at much less cost all present heating facilities would be to cease burning coal altogether. This he proposes to do in a novel manner, which, if thoroughly successful, would enable us to do away, among other things, both with coal mining and with coal smoke. He does not see why our gas retorts should not be in the bowels of the earth, where the coal could be readily converted into gas, in lieu of going through the prevailing difficult work and enormous expense incident to raising the coal to the surface for the purpose of there obtaining the very same product. The latter could then, of course, be employed in any manner desired, especially in gas engines, which are the most economical of power producers, giving, as they do, an efficiency of thirty per cent as against an efficiency of less than fifteen per cent from the average steam engine. Electricity could, even at the pit-head, be generated by the gas engine and conveyed under high tension to very long distances.

Sir William Ramsay has completed arrangements with a prominent colliery proprietor which will enable him at an early date to carry out all necessary experiments to prove his contentions. The advantages he claims are:

Electric power for railways and industries at one fifth, and possibly one tenth its present cost.

"If only one tenth of the amount of coal is used by the means proposed, you would multiply by ten the years of life left to the coal field. All the supplies of coal that are at present worthless could be brought into use. A seam must now be two and a half or three feet wide before it can be worked. In the new era it might be under a foot thick, and a half shale, neither worth mining nor worth having even if it were mined. There are plenty of worthless seams where there is no population. There may be of course unforeseen difficulties. There are always difficulties, but I hope soon to prove the value of the experiment."—SIR WILLIAM RAMSAY



One of the exhibits at a recent London exhibition that drove home to Englishmen how much power and fuel they waste by tolerating their murky, smoky atmosphere.

The consequent electrification of the railways and the supply of electric power, instead of coal, to factories.

Domestic lighting and heating at a fraction of their present cost

Such a saving of fuel as will prolong the life of the coal fields almost indefinitely

And, a saving of man—for, in place of miners, the workers who will be most needed will be skilled mechanics

In a recent interview, Sir William said that his intended experiments are likely to cover a period of several months They will be made with a practically worthless stratum of coal, located as near surface as possible to lessen expense To reach this stratum a bore-hole will be made, which need be only a foot and a half diameter through which a tube, about six inches in diameter, will be put down to keep it free from water As this tube descends it will naturally reveal the exact nature of the various strata "Thus, there will be no expensive shaft to sink, no tunnels to drive, no rubbish to remove Inside this tube, you could insert two smaller pipes, one inside the other, the smaller of the two for the purpose of pumping out the water, and the other for passing down air, steam or small quantities of water to burn with the coal—there is nothing new in that. The coal, of course, would be easily ignited, in the first instance by passing down an electric wire which would then be withdrawn. Your gas engines would enable you to utilize thirty per cent of the fuel value of the coal In other words you double your yield of energy. Transmission from the pit's mouth through high tension cables need present no difficulties In California they have sent it two hundred miles, and there is no reason why it should not be sent very much farther. Any coal that is too bad to be worth mining could be utilized in this way, it could be made to burn where it lies At first, of course, you may find coal owners objecting to setting their coal mines on fire Also, it may be objected that, as the coal is burned out this ground will sink So it will, but this already happens in the salt districts, and nobody minds it much, it happens gradually, and people just accept it The existing coal mines, I should say, would be kept open as a sort of reserve The change is bound to be gradual And for steamships, naturally, the electricity from the pits would be useless; they will always need coal or some other form of fuel"

When asked if the producer-gases to be brought up from the coal strata by the above-named process could be utilized for any other purpose than working gas engines, Sir Will-

iam said: "It is a question of cost. You cannot convey this gas very far owing to the expense of piping. If it could be used at a reasonable distance, perhaps ten miles, it might pay to put down piping. The cheapest thing to do, however, would be to convert the gas into electric power and distribute electric current. By means of the high tension current I spoke of, the cost of electric power would be reduced to about one tenth of a penny a unit, compared with a penny a unit that is now the price for power, and with fourpence a unit that is the price for light. Here then would be the means of electrifying all the railways at once, and of supplying power to all the factories. This would be a start. It is not possible to say at this moment what you might not do besides. As soon as it was shown that power could be purchased at one tenth, or suppose we say only one fifth the cost that it is at the present time, I feel that railway companies, factory owners and others would have no hesitation in using it. Indeed, they would be bound to do so. Another enormous advantage of this conversion of coal into gas and electricity would be the saving in fuel. I made a statement some time ago that in one hundred and seventy-five years, the coal supply of Great Britain will be exhausted. Mr McKenna has challenged this statement, remarking that it did not take account of the reserves. These reserves, however, are very questionable, and I replied at the time that supposing they were taken into account it would only give the coal fields a duration of some two hundred and fifty years. In this connection I may add that, instead of the blazing fire on the domestic hearth and in place of the present rather costly system of heating rooms by gas or the existing apparatus for electric fires, the novel and possible alternative of obtaining heat by means of wires through the carpet would be practicable. Get your carpet at a temperature of seventy degrees and your room will be quite comfortable."

A very interesting object lesson as to the wastefulness of our present methods is afforded by the accompanying illustration. The square black pillar, which represents London's annual average soot fall is standing beside a comparative model of the Westminster Clock Tower, and the very small white monument back of the potted plant represents the Cleopatra's Needle on the Thames embankment.

While it would be entirely premature to make any positive statements at the present time either in favor of or against Sir William Ramsay's proposed method of coal mining, the project has in it something exceedingly alluring, and recalls in some respects the work of Frasch, which gave Louisiana a new industry, and well threatened to destroy the sulphur mining industry of Sicily.

Cultivation of the True Cinnamon

THE aromatic spice called cinnamon is the inner bark of *Laurus cinnamomum* Linn., a beautiful tree attaining the size and approaching the appearance of our pear tree. The small, smooth and shiny branches, or young shoots, from the stump alone are available. The leaves are exceedingly variable, and in this respect remind one of our native sassafras, to which the cinnamon tree is very closely related. To produce the commercial bark the trees are allowed to grow for from five to seven years, when they are felled and the stumps allowed to produce young shoots called coppice. The same methods are followed in the East Indies to grow straight and smooth shoots of cinnamon as the basket-willow grower adopts in this country. It is kept coppiced in order to induce the formation of long willowy shoots. A distance of three feet between each stool is allowed in setting out young cinnamon trees, a space of nine square feet being required for each stool to produce the greatest number of desirable shoots. The cinnamon plantation may be regarded as a young forest with a short rotation period and not as a garden, which is regularly cultivated. The cinnamon plantation continues to yield abundantly crop after crop for many years. A good many of the plantations in Ceylon that are now regularly yielding cinnamon were started by the Dutch a hundred years ago and are quite likely to yield crops for a hundred years to come.

The cinnamon is cultivated in about every part of the East Indies, but it flourishes most profitably and is found most plentifully in Ceylon in the siliceous soil with an admixture of vegetable mold. It is said to be a native also of the Malabar Coast, and has been introduced into Java, Reunion, the Cape Verde Islands, Brazil, the West Indies and Uganda in East Africa. In Ceylon it produces the sweet taste, aromatic smell, and the pale brown or russet color, which renders the bark so valuable as an article of commerce and useful as a spice. Cinnamon bark from plants, even of the genuine kind, when grown in low marshy ground, subject to inundations, loses its characteristic properties. The cinnamon plant requires a certain amount of soil moisture for the full development of the spice, but stagnant water injures its flavor. The whole of the Ceylon coast is sandy and moist, and is generally favorable for the growth of cinnamon, which flourishes best in a hot and damp climate such as is there found.

When the young cinnamon shoots are ready to be cut off, the Cingalese laborers, called Chalias, provide themselves with sharp light bill-hooks and stout cord with which to tie up the sticks. By the middle of each day the cutters have sufficient shoots to occupy themselves in the barking process the remainder of the day. The bark is then slit open longitudinally on opposite sides with a curved sharp-pointed knife; on being carefully stripped off, it is laid aside to dry for about two days, when the epidermis is scraped off with a broad blunt knife about two and a half inches long. After the cuticle is removed the bark is assorted into three quality classes, according to thickness of bark and brightness of color; the short pieces of each kind are set aside, to be placed in the interior of the pipe, while the longer ones are placed outside. The piping or quilling then commences, the peeler so selecting the bark that very little cutting at the ends is required to form them into proper lengths. The quills are made into uniform lengths of three feet and a half, and three layers of the bark or quill, inside each other. Much of the value of the spice depends upon the proper grading in quality classes.

It is generally calculated that ten fairly productive stumps yield one pound of thoroughly dried bark, and that the shoots growing up from the stumps mature every two or three years. After the first crop of shoots is harvested a fresh supply of young shoots appears which grows very rapidly as soon as the wet season starts in. Those shoots which are considered fit for cutting are usually three fourths of an inch in diameter and from five to six feet or more long.

It is well known that the bark yields an essential oil, and from the leaves an oil is obtained which resembles clove oil, and is known in commerce under the name of "oil of cloves." From the root of old trees is extracted an excellent camphor, and the flowers are also used as a spice. The pulp of the berries is sometimes made into cakes.

Imports of Cinnamon, and Chips of, Unground, Entered for Consumption in the United States During Years Ended June 30th, 1900 to 1911.

Years Ended June 30	Quantity. Pounds	Value.
1900	418,374	$59,544
1901	483,992	77,685
1902	358,832	55,512
1903	641,214	92,646
1904	675,873	80,502
1905	621,948	78,425
1906	645,758	78,473
1907	777,597	106,827
1908	520,460	76,634
1909	1,022,846	93,856
1910	921,042	87,798
1911	1,147,428	100,640

How Nature Punishes the Parasite

A NATURALIST, observing the difficulty a butterfly has in breaking from its chrysalis, determined in the kindness of his heart—they are not all calloused, those men of science—gently to cut away certain impediments, so that it could the more easily free itself. The result? Instead of emerging strong and large and beautiful, it was a frail thing indeed, without strength in its body or beauty in its wings; the very struggle of which the scientist's mistaken kindness had relieved it, had contained and conditioned the source of its beauty and virility. Again: Ducklings helped from their shells differ from those which have to fight their way out, in being stunted weaklings—if they are not still-born, or die soon after the too-solicitous hand has helped them out of the shell-stage of their development.

Biology divulges many forms of life which will not take the trouble to find their own food, but prefer to borrow or steal it from the more industrious; this is oftentimes an acquired habit, and a most grievous, bad one, for which nature invariably exacts a dreadful penalty. The dodder begins life with excellent intentions, strikes its root deep in the soil, means evidently to be really independent. But after a brief period of dignified self-support, it comes to fix sucking disks into the stems and branches of adjacent plants, until finally it does nothing at all for its self-support, and instead draws all its supplies ready made from the sap (the life-blood) of its host. Having thus become a parasite, needing no organs of nutrition of its own, nature takes them away: and thus the adult dodder presents the miserable, degraded spectacle of a plant without a root, a twig or a leaf, and with a stem so frail as inadequately to bear its weight. In the mistletoe the parasitic habit has been hereditary through so many generations that the young forms begin at once an ignoble and dependent existence; the berries, which contain the seeds of the future plants, are developed to minister especially to this degeneration; for they glue themselves to the branches of [illegible] and apple trees.

The ordinary crab should excite warmest admiration; and he has a "business end" to him which commands respect. He leads a rough and perilous life; jagged rocks are his habitat; and among these he is dashed about by every wave, while on every side his piscine enemies attack him. As a defense against such environment he has developed, by the aid of sympathetic nature (kind always to those who would help themselves), a strong and serviceable coat of mail. But not so that poor and needy relation, the hermit crab. The latter's progenitors long ago hit on the dubiously wise idea of re-utilizing the plenteous, well-built habitations that had been evacuated by other mollusca. The result of this house-free, purloining policy is that generation after generation this kind of crab, dwelling in its appropriated shell, has ceased to bother or concern itself about questions of safety. Wherefore Nature (as stern as she is just) has written this sin against evolution, this semi-parasitism, most plainly upon the hermit's organization, for the reading of all, to its shame. This apology for a crab has suffered in its anatomy precisely in proportion as it has borrowed or filched from its environment; it is now no more a lusty, perfect, commendable crab; its body has sadly deteriorated; several vital organs are partially or wholly atrophied; its sphere of life has become deplorably limited. Having by a cheap and unworthy expedient secured safety, it has in consequence fatally compromised its independence. Not now needing to construct its own coat of mail, a vital inducement to a life of dignified and vigilant exercise of its own powers is correspondingly withdrawn. A number of functions have struck work; consequently the whole organization has become enfeebled. By the stern law of evolution—that an unused organ must atrophy—the hermit has not only lost all power in certain parts, but also those parts themselves. Instead of the thick, chitinous shell of the self-respecting crab, the hermit can show only a thin and delicate membrane; this half-naked and woe-begone hobo of the seas presents certain of its limbs as rudimentary, or so small and wasted as to be but pitiful apologies for limbs. The only compensation for all this degeneracy is that such additional tail development as will permit it to hold on to its extemporized retreat, has been required.

Almost every animal is a living poor-house, harboring countless lazzaroni, supplying them gratis, not only with a permanent home, but with all the necessities, and indeed also all the luxuries of life. The animal is thus an unwilling host, to its own prodigious discomfort. It is a questionable philosophy of David Harum's, that "a moderate amount of fleas is good for a dog, it keeps him from broodin' on bein' a dog." The flea gets too much the better of the bargain.

Nature abounds in such examples as these of parasitism and semi-parasitism. And deductions are obvious: Effort is quite as essential for human well-being as for that of any animal. In the universal scheme the genus homo is conditioned as to his life processes, precisely as is every other creature in the cosmos. Man is perversely foolish to imagine the universe to be anthropocentric, and that he can afford to flaunt the "eternal verities." In the hands of Nature he is as helpless as any other sentient thing. Her laws of heredity, of environment, and of function govern him as inexorably as they do the dodder and the hermit crab. While vitiating their own stamina, the indolent and the selfish inflict a most grievous phlebotomy upon the virile and the self-respecting portions of the race. The charity which helps the individual to help himself is altogether laudable. But indiscriminate charity is a cruel wrong, both to the recipient and to his community. And is not this true also of paternalism? When will the body politic come to appreciate that what its government bestows upon one portion of its citizens must inevitably—there can be no other source—be abstracted (in the form of taxes) from the remainder of the people?

Experiments With an Aeroplane Gun

SOME interesting experiments were made at the Brasschaet military aeronautic grounds in Belgium with a mitrailleuse mounted on an aeroplane. The mitrailleuse is said to be of American invention, and is designed specially for this purpose. The object is to defend the aeroplane against attacks from the ground, and especially against other aeroplanes or airships. The gun is air-cooled and is of very light build, and it can fire as many as 500 shots per minute, each ball having 8,000 feet per second initial speed. It was a real problem as to how to mount the gun upon the aeroplane in the proper way, but this is now successfully done. A special suspension device allows the gun to be aimed in all directions, and means are provided so that the ejected shells will not endanger the helice. Other devices serve for the sighting and for compensating for the action of the wind and the like.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Card Trick

To the Editor of the SCIENTIFIC AMERICAN:

Under the above heading on page 55 of your issue of July 20th is given a card trick called the "Hawaiian Islands," which depends upon the fact that cutting a pack of cards never alters the relative position of the cards provided that if necessary you regard the top card as following immediately after the bottom card in the pack. The following trick depends upon the same fact. Deal the cards of a pack face upward on the table, calling them 1, 2, 3, etc., as you put them down, and mentally noting the card first dealt. Ask some one to select a card which is being laid down, and recollect its number. Turn the pack over and let it be cut as often as the person likes. Ask the number of the card chosen. Then deal the cards one by one, and when you come to the original first card, count it silently as 1, and the selected card will appear at the number mentioned. If all the cards are dealt before reaching this number, turn the cards over and go on counting.

H. S. ARNOLD.

New York.

Drain Pipes and Mosquitoes

To the Editor of the SCIENTIFIC AMERICAN:

The section in which I lived last year is practically immune from mosquitoes. Last summer, however, we were troubled considerably. The country is hilly and well drained. There are no swamps or other breeding places.

One evening just before dusk, while lying in a hammock, I noticed a swarm of mosquitoes around the coping of the house. I got a ladder and soon discovered the source of the mosquitoes. The gutter along the coping had sagged and the last rain had left considerable water in it, which was quite stagnant and full of wrigglers. We repaired the gutter and the mosquitoes disappeared.

It has occurred to me that you might like to have this information.

C. S. K.

Philadelphia, Pa.

[The SCIENTIFIC AMERICAN has from time to time called attention to gutters and drains as breeding places for mosquitoes. So, too, the United States Department of Agriculture has issued popularly worded bulletins in which this information is conveyed. Although our correspondent has discovered a well-known fact for himself, it seems to us worth while to publish his communication since it may serve to assist others in ridding themselves of our summer insect pests.—EDITOR.]

The Aviettes

To the Editor of the SCIENTIFIC AMERICAN:

With reference to article on page 9, SCIENTIFIC AMERICAN of July 6th on the failure of the Aviettes, is it not a fact that bicycles being dependent for their driving effect on the friction between the road surface and their wheels like all other self-driven vehicles cannot be raised from the ground by any means except an aerial propellor, assuming it to be possible to fit such a propeller. As the planes tend to raise the bicycle and so reduce friction at the wheels, the bicycle would, it appears, necessarily stop immediately it began to feel the liftup effect produced by them.

It would interest me and several other people very much to hear your views on this matter.

Achnahaird, Ullapool, Ross, N. B. D. A. LAWSON.

[Our correspondent is right, if his supposed aviette runs constantly at an effective lifting angle, but if kept at zero lift, it would permit the wheel to have full grip on the ground until its full speed was acquired, whereupon the plane could be uptilted and suddenly have its maximum lift.—EDITOR.]

Wanted: A Small Gasoline Plow

To the Editor of the SCIENTIFIC AMERICAN:

It seems to me that inventors are slow in getting The Real Machine devised for the small farmer to supplant the two horses to do the work in pulling the various plows more economically and efficiently than two horses can do the same work.

I cannot delve deep in the matter of gasoline propelled vehicles, but possibly some suggestions I have to make would be of some value to a would-be inventor. A machine of this kind should be as compact as possible in order to make a turn in a given radius at least that of a mule. It should have rather high, wide-tired wheels with heavy gearing. The motor plant should be so installed that it will rest on spring cushions attached to frame, instead of being rigid to frame, thus obviating the necessity of cushion tires. Now if it is mechanically possible to couple the power plant to a differential gear, resting on a spring in the above manner, I cannot see why such a machine could not be made practical for the aforesaid purposes. Would be glad to read some comment on this.

Brewton, Ala. E. M. BLACKSHER.

Fastening Dress Shields Simply

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of the SCIENTIFIC AMERICAN of June 29th, under "Notes for Inventors," request is made for some simple method of fastening dress shields to dresses. For a simple and effective method hooks and eyes will answer the purpose. Sew a hook at each end of shield and one at extreme edge of side of shield that rests against side of dress (at points where sewing or pinning would ordinarily be done). Attach to dress an eye to correspond to each hook. If small hooks and eyes are used they will be almost invisible. By fastening eyes to each dress the shields may be readily removed from one dress and placed in another.

Brooklyn, N. Y. J. A. G. HARTON.

The Rail Question

To the Editor of the SCIENTIFIC AMERICAN:

I presume you have seen in the daily papers that the 18-hour train of the Pennsylvania Railroad, which met with an accident on a straight track, going about 60 miles an hour, was not running faster than her usual rate of speed because she was on time. This may bring about a reduction in the running time of the 18-hour trains of both of the roads and I hope it will set the people to thinking that cold weather is not the only thing that causes accidents to these fast trains.

I have not seen as yet an official statement which gives the cause of the accident, nor will I draw any conclusion as to the probable cause. Attached to this letter you will find a list of accidents which happened to our fast trains during the month of December, 1911, and the months of January, February, and March, 1912, with the causes and the number killed and injured. I got my facts from the daily newspapers, those of good character only, the *New York Evening Post* being one, and correct these facts by the monthly statement of accidents issued by the *Railway Age-Gazette*. Mr. S. O. Dunn, as you know, is a careful man; the reports that are printed in his paper I believe are true and unbiased. This list that I have sent you is a copy from my book and if you take the time to examine it you will see that broken rails were not by a good deal the causes of all the wrecks or even some of the worst ones.

My firm belief is that the rail question needs attention more than this cry for reduction of speeds. A rail that is frozen will break, I believe, as well under a freight train as an 18-hour limited. It is known that our high carbon steel rails do first rate service on a freight road, such as the Buffalo, Rochester & Pittsburgh, but that on trunk lines where we have freight and high-speed passenger trains they are apt to get brittle with disastrous results. Not many people are aware of the fact that on a certain trunk road in the Middle West, because an engine was not properly balanced, 150 broken rails were removed the next morning on one side of the track after that engine with its fast train had passed over it in her run; or that on another trunk line a little farther north in a 100-mile stretch 200-odd broken rails were removed after a night's traffic had passed over it. These facts may illustrate how important the rail question is, not so much the speed question, though I think the State of Michigan was right when it prohibited the railroads in that State to run their trains faster than forty miles an hour during the winter and part of the spring months.

The next question in the speed reduction of our fast trains is, are our trains really fast? I have added to this list a list of fast trains which I have copied from *Railway and Locomotive Engineering*. While I will not vouch for its correctness, I have no doubt that Mr. Sinclair's paper which is first-class in every respect, will. If you look at the list you will find that fast American trains do not figure as prominently as they ought to. The European roads do not have as heavy trains as we do, nor is their equipment as strong as ours. But from all I hear I believe their tracks and roadbed are better than ours in a good many ways. Take, for instance, the London & North-Western, and the use of its steel chairs, two on each tie. Not many roads in this country use it, and I don't know of any unless it is possibly the Pennsylvania. None of the European roads to any great extent has steel equipment, and only one in this country has progressed to any great extent. I refer to the Pennsylvania, and to it should be given the credit of its introduction. As a matter of fact, that road is way ahead of the others anyhow.

The Interstate Commerce Commission was quite right when it took up last year the matter of safety devices and ordered that certain of these devices be used on the equipment, and let us hope that that same body will order the railroads soon to order steel equipment for its passengers. If the railroads will not voluntarily stop the killing of the passengers, then legislation must. The railroads are not all to blame. That same body mentioned above makes mistakes, but who has not? Labor organizations do not help in the reduction of accidents as they might and as they ought. In fact, I believe they help them. If I may quote James O Fagan, in his "Confessions of a Signalman," he says that a division superintendent says, "*Within a week we could put a stop to these accidents.*" I believe Mr Fagan is right. This accident question must and ought to be investigated properly, and the sooner the better for the public.

CHARLES E FISHER.

Taunton, Mass

ACCIDENTS TO FAST TRAINS IN UNITED STATES DURING DECEMBER, 1911, AND JANUARY, FEBRUARY AND MARCH, 1912

December 18th, on the Chicago, Milwaukee and St Paul a rear-end collision near Odessa The train was the all-steel "Columbian" It was found that the rear brakeman failed to go back and flag a following train The construction of the cars also was criticised Ten killed and twelve injured

December 27th, on the C C C & St L (New York Central Lines) the "Twentieth Century Limited" was derailed near Lagrange, Ohio Fifteen were injured Broken rail the cause

December 28th, on the Chesapeake & Ohio, the "Fast Flying Virginian" was derailed near McKendars Two were killed and five injured. Broken rail the cause

December 30th, on the Great Northern, the "Oregonian" was derailed near Finley Six were killed and thirteen injured. Broken rail the cause

January 9th, on the L S & M S (New York Central Lines), the "Knickerbocker Special" was wrecked near Dunkirk, N Y. Three were injured Engineer of special could not see signals in a snow storm, ran by and hit another engine

January 12th, on the L S & M S (New York Central Lines), the "Twentieth Century Limited" collided head-on with an empty train of the C & E I R R at Chicago Ten were injured Engineer of C & E I train failed to obey signals

January 19th, on the New York Central & Hudson River, "Fast Mail, No 3," was derailed near Crittenden, N Y Two were injured Caused by a drawbar pulling out of a car and derailing that same car

January 19th on the New York Central & Hudson River, "Fast Mail, No 3," collided with a string of empty mail cars when backing into the station at Buffalo, N Y Twenty-two people were injured Caused by a misplaced switch

January 22nd, on the Illinois Central, the "Panama Limited" smashed into the rear end of train No 25 Four were killed and three injured The blame was placed on the crew of No 25 for not going back and flagging the Limited and also on the engineer of the Limited for not approaching Kinmundy, where the accident took place at a slow rate of speed, where he knew No 25 stopped to take water.

February 14th, on the Great Northern, the "Oriental Limited" was derailed near Doyon Forty-one were injured Spreading rails caused the accident

February 15th on the Pennsylvania the "Pennsylvania Limited" was derailed at Warrior's Ridge Five were killed and sixty-five injured Caused by the breaking of the equalizer bar on the first engine which derailed the train

February 17th, on the Pennsylvania Lines, the "Pennsylvania Limited" collided into the rear end of a work train near Larwill, Ind Four were killed and twelve injured Due to high speed through a dense fog

February 20th on the Pennsylvania, the "Pennsylvania Special" (18-hour train) hit a switching engine in the Harrisburg yards Two were injured Caused by a brakeman throwing the switch and letting the switching engine run ahead of the "Special"

March 4th, on the Pennsylvania Lines, the "Pennsylvania Special" (18-hour train) was derailed near Bucyrus, Ohio No one was injured Caused by the breaking of the wheel on the tender of the second engine

March 7th, on the L S & M S (New York Central Lines), the "Twentieth Century Limited" was derailed near Cleveland One was killed and nineteen injured Caused by a wheel breaking on a sleeper

March 7th on the C C C & St L (New York Central Lines), the "New York Central Limited" was derailed near Bellefontaine, Ohio. Two were hurt Some one allowed a box car to block the Plum Valley Street Crossing and the train was derailed, cutting the box car in two

March 13th on the New York Central & Hudson River, the "Twentieth Century Limited" was derailed near Poughkeepsie, N Y Twenty-three were injured Caused by a broken rail

March 13th on the C C C & St L (New York Central Lines), the "New York Central Limited" struck a freight train near Greencastle, Ind Three were killed and eighteen injured Caused by the signalman reporting a clear track when it was blocked by a freight

In the above list the numbers reported killed and injured include employees and passengers. Persons killed and those who are seriously enough injured to die within 24 hours after the accident are reported killed. Persons injured to require medical attention are reported injured.

Fastest Long distance Trains

Railway	From	To	Miles	Speed miles per hour
Northern (France)	Paris	Calais	185 1	50 72
Prussian	Berlin	Hamburg	177 69	52 51
London & North-West	London	Edinburgh	393 5	50 77
N.Y C & L S & M S	New York	Chicago	962 49	50 66
Caledonian	London	Edinburgh	401 5	50 18
P.L. & M. (France)	Paris	Mentone	687 5	49 10
Pennsylvania	New York	Chicago	897 0	47 21
Orleans (France)	Paris	Bayonne	488 0	49 3
N Y.C & H R	New York	Buffalo	440 0	49 3
O. & S (France)	Paris	Madrid	903 0	38 49
Various.	Ostend	Vienna	822 0	37 85

Copied from the June, 1912, *Railway and Locomotive Engineering.*

THE maneuvers of the sanitary department of the military government of Paris, which take place annually at the Gravelle camp, were unusually interesting this year. The exercises included the establishment of a rescue service by automobile, a relay ambulance service and a temporary hospital, in addition to curious experiments in training dogs to search for wounded men. The most striking characteristic of these maneuvers was the extensive employment of automobiles for the expeditious rescue of the wounded.

The most remarkable specimen of the new equipment is an automobile operating room, in which surgical operations can be performed at the battle-front in conditions as favorable as those afforded by a hospital. Severe abdominal wounds, which are very common in modern warfare, cannot be operated upon properly by the ordinary field service, and in many cases the removal of the patient is equivalent to a sentence of death.

The new vehicle, which has a 40 horse-power motor capable of developing an average speed of 20 miles per hour, is furnished with all of the accessories and the latest improvements of a hospital operating room. Its principal compartment, the operating room proper, contains an improved operating table and a wash basin supplied with sterilized water. In front is a smaller compartment, containing the sterilizing apparatus and the electrical apparatus, which is operated by the motor, whether the vehicle is in motion or at rest.

A very ingenious arrangement enables the surgeon to locate the bullet accurately by the application of Roentgen rays. The operator, shielded from diffuse light by a photographer's hood, moves the fluorescent screen over the patient's body until the shadow of the bullet falls on a small hole at the center of the screen. By inserting a pencil in this hole the position of the shadow is marked on a sheet of translucent paper, ruled in squares, which is placed under the screen. The angle of observation is then altered slightly and the new position of the projection of the bullet is marked in the same way on the ruled paper. From the distance between the two marks, the depth of the bullet can be obtained, by referring to a table computed in advance.

The operating room also contains a complete trepanning apparatus, which is operated by a special motor.

The vehicle carries an apparatus for sterilizing water by ultra-violet rays, for the use of the troops. The water is drawn from any convenient brook or pond by an electric pump.

A folding tent, for the shelter of patients before and after operation, is attached to each side of the vehicle.

The employment of automobile operating rooms of this sort would save many lives. In the recent war in Manchuria the mortality among the severely wounded was 90 per cent, because of the inadequate facilities for prompt operatory treatment. This mortality could probably be diminished by two thirds by the use of automobile operating rooms in which operations could be performed in perfectly aseptic conditions, without loss of time, before the removal of the patient from the field.

The operating room of the motor hospital contains operating table, trepanning apparatus and sterilizing basin.

Showing the method of suspending stretchers in a military hospital vehicle, and the positions of the patients.

The motor hospital, besides its operating and sterilizing equipment, carries a shelter tent on each side, ready for pitching.

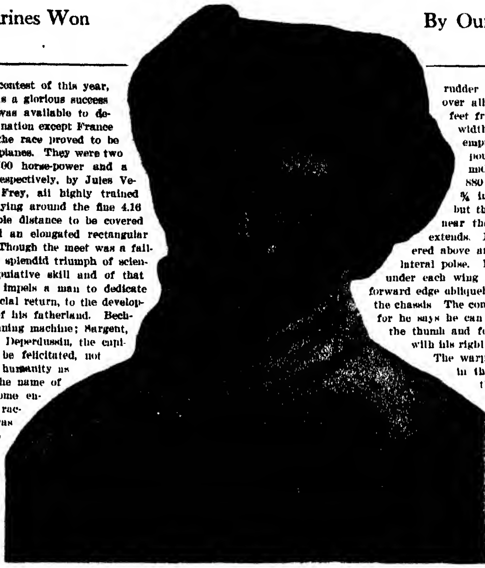
The James Gordon Bennett Aviation Contest of 1912

How Vedrines Won

By Our Staff Correspondent

THE international aeroplane speed contest of this year, though a failure in one respect, was a glorious success in another. No American aeroplane was available to defend the Bennett Aviation Cup, and no nation except France attempted to take it from us. Thus the race proved to be a friendly rivalry between French monoplanes. They were two Deperdussin machines of 140 and 100 horse-power and a Hanriot of 100 horse-power, piloted, respectively, by Jules Vedrines, Maurice Prevost, and André Frey, all highly trained aviators who did their most skillful flying around the fine 4.16 mile course. In exact figures the whole distance to be covered was 124.8 miles in thirty laps around an elongated rectangular course terminated by hexagonal ends. Though the meet was a failure for lack of representation it was a splendid triumph of scientific design and construction, of manipulative skill and of that highly honorable sportsmanship which impels a man to dedicate his fortune, with scant promise of financial return, to the development of a noble art and the renown of his fatherland. Bechereau, the scientific designer of the winning machine; Sargent, the constructor; Vedrines, the aviator; Deperdussin, the capitalist and initiative spirit, all are to be felicitated, not only as conquerors for France, but for humanity as well. And to this list must be added the name of Seguin brothers, whose wonderful Gnome engine is a vital part of those marvelous racers. As a mere spectacle the contest was worth journeying a thousand miles to see. The day was cloudless and hot, but relieved by a fair breeze. Owing to the heat on the vast meadowland, and the numerous trees in the interior of the circuit, the air was filled with eddies enough to keep the racing pilots constantly alert and afford palpable evidence of their skill. There was frequent tossing and rocking of the aeroplanes, too often requiring a liberal margin in rounding the pylons, but these effects seemed instantaneous; for a machine moving 150 feet per second has little time to be disturbed in crossing the average hump or airhole. Usually the flight seemed like that of a projectile, or, as was aptly said, like that of a winged cannon moving breech foremost swiftly along its level course through the air. The turns through 60 degrees at each pylon were made with marvelous suddenness. The flyer would shoot like an arrow straight for the turning point, bank suddenly round the pylon, recover its level instantly, without rocking, then shoot in rectilinear flight again, but a few yards above the earth. When a lumbering biplane plodded overhead, it seemed to stand still as the real racers shot beneath, gaining on it more than sixty miles an hour.

As no accident impeded Vedrines in his official flight, he was easily the winner as anticipated. Prevost came second, as expected, and Frey third. But Frey stopped on the 24th round because of motor trouble. The official record gives Vedrines' average speed for the entire course as 105.5 miles an hour, Prevost's as 100.05 miles an hour, Frey's over 23 laps, or 94.2 miles, as 98 miles an hour. Vedrines fell a trifle short of his previous record of 106 miles per hour, while Prevost made a new record for a 100 horse-power monoplane. But both show marked improvement in last year's cup race record of 78 miles per hour. At the end of the race Vedrines flew three times around the course, a distance of 12.43 miles, in 6 minutes 55.95 seconds, making a new world's speed record for 20 kilometers. The official time for each lap shows that the air-cooled, fourteen-cylinder Gnome engines maintained their power with great regularity.



Jules Vedrines, who won the Gordon Bennett race in a one hundred and forty horse-power Deperdussin monoplane.

The 140 horse-power Deperdussin monoplane driven to victory by Vedrines is a marvel of compactness, strength and efficiency of form. It has a fish-shaped body or fuselage with a tractor screw in front, a cock-pit just back of the wings, and in the rear a movable horizontal rudder hinged to a fixed concave one for lifting, as also a movable vertical rudder hinged to a fixed vane. The machine over all measures 21 feet fore and aft, by 19½ feet from tip to tip of its wings, whose average width is about 5 feet. It weighs 710 pounds empty, and in the official race carried 117 pounds of gasolene, 6½ gallons of castor oil, making its total weight without pilot about 880 pounds. The wings are cambered about ¾ inch, which makes them seem flat below; but they are quite convex above, being thickest near their forward edge, where the front spar extends. Needless to add that they are tautly covered above and below, and are warped to govern the lateral poise. In addition to the usual four stay wires under each wing there is a fifth running from the outer forward edge obliquely inward and rearward to attachment at the chassis. The controls are the especial delight of Vedrines; for he says he can maintain his flyer in perfect poise with the thumb and fore-finger of his left hand while saluting with his right hand, and, in fact, throughout the course. The warping is effected by rotating a pilot wheel in the direction the machine is to be tilted; the horizontal rudder is operated by pushing the wheel fore and aft, thus moving the rocker arm on which it is mounted. To this rocker arm are attached the push rods which operate the horizontal rudder at the rear. Each warping wire, passing from the hub of the pilot wheel, thence along the rocker arm supporting it, runs down through the fuselage to the horizontal arm of a bell-crank lever pivoted on the lower part of the chassis. The other arm of the lever protrudes vertically downward some inches and at its lower end unites with the warping wire of the corresponding wing. When the wheel is rotated it accordingly turns these two bell-crank levers in opposite directions, thus causing the wings to warp oppositely. The steering rudder is worked by the feet actuating a horizontal rocker arm just above the floor of the chassis, the ends of the rocker arm being attached to the rudder wires. Thus the pilot seated on a cushion on the floor of the fuselage, his head just protruding above its ceiling, and the base of his skull resting against a special cushion, seems the picture of comfort, and the more so because of the wind shield just before the cock-pit.

Vedrines rounding a pylon in the Gordon Bennett race. His average speed was 105.5 miles an hour for the course of 124.8 miles.

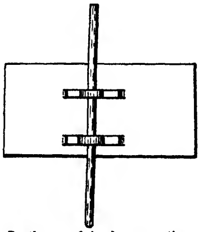
The fish-shaped fuselage is of nearly circular cross-section at its front, near the revolving motor, but rearward it is of oval section. From the side it much resembles a headless fish with rather straight back and more curved ventral part. It was constructed of long poplar boards 5 inches wide by ⅛ inch thick, bent in layers spirally round a solid form, the grain of one layer running obliquely to the grain of its neighboring layer. When the whole is dried the form is withdrawn and a hole is cut for a cock-pit in the remaining shell. At the front of the shell, or fuselage, is placed the 14-cylinder revolving Gnome engine, surrounded with its oil shield. At the front of the motor is attached the screw propeller of 2.35 meters diameter by 3.15 meters pitch, bearing a coaxial convex circular wind shield which allows the air to rush directly against only the outer part of the revolving cylinders. Thus, the engine meets less resistance, and is more cooled than if the shield were omitted. Below the fuselage protrudes the frame of the chassis, and is united by elastic bands to the axle of the running gear. The two wheels are smoothly covered with sheet alu

(Concluded on page 251)

Simple Depth Gage

By J. A. Brearley

IN the SCIENTIFIC AMERICAN of February 4th, 1912, there is a cut of a depth gage designed by Mr Clark. Herewith is a sketch of one which the writer has used for several years, and which is perhaps more simple and more quickly made than the one presented by him.



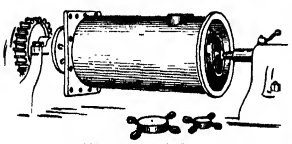
Depth gage of simple construction.

The rod is made of a piece of ⅛-inch drill rod, and the body of a thin piece of sheet steel. The straps through which the rod passes are made by cutting slits in the sheet forming the body of the gage, and for the rest the sketch is self explanatory.

The one in the writer's tool box was made in less than ten minutes of scraps such as may be found in any shop

A Spider Center

OFTEN a machinist has an awkward-shaped piece to face off in the lathe. The chuck will not grasp it, and the openings at the end are much too large for bull centers. A spider center will then be found useful. Such a center may be made by taking a round boss of cast iron, about 1½ inch thick and 3 inches in diameter or larger, drilling four holes in the periphery, spaced off evenly, and after tapping out, putting in



A spider center for lathe work.

four set-screws. The boss has a countersunk center for receiving the lathe center when in use. The illustration shows the spider center in position. Larger sizes should be grooved out annularly on one face, giving room enough to reverse the set-screws, so that the points will project outward from the spider, which will allow more leeway for different sizes.

A Camera Support for Automobiles

By Frederick E. Ward

HARDLY anybody nowadays would think of going on an extended automobile tour without taking along a camera; but unfortunately the souvenir value of the pictures obtained is greatly lessened by the many unfavorable conditions under which the exposures have to be made. Chief among these is the lack of a suitable support for the camera.

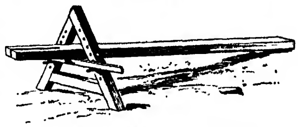
In Fig. 1 is shown a bracket attached to the back of an automobile seat, in such position as to hold the camera with the lens in about the same position as would be occupied by the eye of a person in the seat. This not only serves as a support to hold the camera when it is desired to make exposures, but it gives the novel effect shown in Figs. 2 and 3, where parts of the automobile are included in the foreground. This makes the pictures appear more nearly as if viewed from the machine, and greatly enhances their value as souvenirs.

The bracket may be bent up from a piece of ¼ inch by 1 inch cold-rolled steel, and by rounding off the sharp corners and giving it a coat of enamel, it may be made to match the trimmings of the car, to which it may be attached as a permanent fitting. When needed, the camera attaches to it in a moment, by means of the usual tripod thumbscrew, through a ¼ inch hole left for the purpose.

How to Hold Heavy Work to be Sawed

By William Grötzinger

A GOOD way to hold large heavy work that is to be sawed is shown in the sketch. The work is passed through the triangular opening in a wooden frame, nearly in the form of the letter A. When the frame and work lie at an obtuse angle, they constitute a three-legged stool. The upper edges of the board become wedged fast in the sides of the triangle, and the lower side of the board rests upon a cross piece,

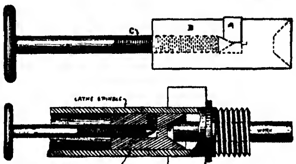


Device for holding boards to be sawed.

which can be placed at various heights, according to the size of work that is to be held. In sawing, the man rests his knee on the work, near the top of the frame, and the board is changed end for end, when sawn through half its length.

A Stop for Lathe Spindles

WHEN cutting off a large number of small shafts, much time is consumed in measuring the work at each cut. To save this time, the stop illustrated herewith was constructed. Not only did the device serve as a stop, but it assisted in holding the work concentric with the hollow lathe spindle. A small block *A* served to lock the stop *B* in the spindle at any desired position. When the stop had been ad-



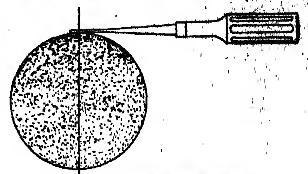
Adjustable stop for hollow lathe spindles.

justed to the desired location in the hollow spindle, the screw *C* was turned, causing the cone end of the screw to bear against the block *A* and jam it against the interior of the hollow spindle. After the stop had been locked in this way, the work was placed in the spindle and run back until it seated itself against the conical recess in the end of the stop, as shown in the sectional view.

How to Grind a Screw-driver

By H. D. Chapman

THERE are but few screw-drivers ground properly. The usual taper end of a screw-driver cuts the slot and the head of the screw away and will not move a screw that is hard to turn. The accompanying draw-

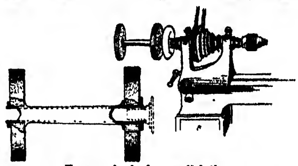


Proper way to grind a screw-driver.

ing shows the right way to grind the end of the blade. Place the end of the screw-driver a little beyond the center. The screw-driver ground in this way will seat itself in the screw and grip the bottom of the slot. The blade ground in this way will have little tendency to twist out when it is turned.

Emery Wheels for Small Lathes

AN emery wheel may be attached to a watchmaker's lathe or to any hollow spindle lathe as follows: Use a hollow arbor with threads on each end. By a thin nut the wheels are held in place; the whole thing then is placed on the outer end of lathe spindle. By making a good fit the friction will carry the wheel. In use, a person does not have to make a change either on his lathe or otherwise, as it is within very handy reach for sharpening tools and drills. The drawing shows an enlarged view in section of the construction, also a view of the lathe head with emery wheels



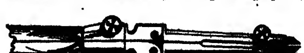
Emery wheels for small lathes.

attached. It does not interfere in the least with working the handwheel or using the wire chucks in the lathe, and need very seldom be removed, although this may quite easily be done. It is better to use two wheels, one adapted for cutting down and the other much finer for producing a keen sharp edge.

Instrument for Drawing Parallel Lines

By H. Bickerstaff

IN the SCIENTIFIC AMERICAN of August 5th, 1911, and again in the issue June 22d, 1912, there appeared suggestions for drawing parallel lines. Here is another idea that I think even better. Insert a black lead in both legs of a compass and by running one leg against



Compass arranged for drawing parallel lines.

the T-square the parallel lines are drawn to any width required. This method is useful for other work besides drawing lines for lettering.

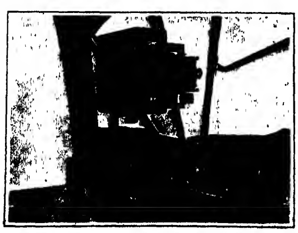


Fig. 1.—Bracket for supporting the camera on the automobile.

Fig. 2.—The old Cape Cod windmill, West Falmouth, Mass.

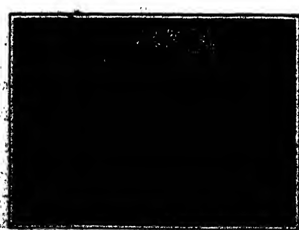


Fig. 3.—Through the Franconia Notch, White Mountains, N. H.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Legal Notes

Abandonment of Trade-mark.—In the case of Levering Coffee Company v. Merchants Coffee Company the Court of Appeals of the District of Columbia holds that the right in a trade-mark is a property right and that intent to abandon must clearly appear from the facts and circumstances surrounding its non-use and that as in other cases intent may be inferred when the facts are shown adequate to support such a finding, but that acts which, unexplained, would warrant an inference of abandonment may be met by a showing of lack of abandonment.

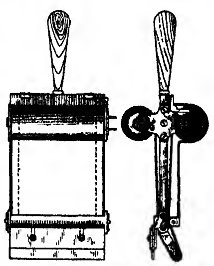
Beer and Near-beer.—In the case of the Independent Breweries Company, the Court of Appeals of the District of Columbia affirms the decision of the Commissioner and holds that a beverage composed of malt and containing less than one half of one per cent of alcohol constitutes goods of the same descriptive properties as beer; also that the mark "Amber Bead" is properly refused registration in view of the prior registration of "Amber" as a trade-mark for goods of the same descriptive properties.

Patents Adjudicated.—In the case of Draper Company v. Stafford Company, 196 Fed. Rep., 501, the Draper patent, No. 527,014, for improvement in looms was held not infringed, while in the case of Parke Davis & Co. v. H. K. Mulford & Co., 196 Fed. Rep., 496, the Takamine patent, No. 730,176, for a glandular extractive product known as "adrenalin," claims 1, 2, 9, 12 and 14 were held valid and infringed, while claims 6, 13 and 15 were not passed upon; and between the same parties, the Takamine patent, No. 753,177, for a glandular extractive compound was held valid and infringed as to claims 5 and 6, and claims 1 and 2 were not passed upon.

Amended Copyright Law.—By Act of Congress approved August 24th, 1912, the Copyright Law is supplemented with respect to moving pictures. The amendment specifically includes in the act the classes of "Motion-picture photoplays" and "Motion-pictures other than photoplays" and requires the deposit with claim of copyright of a title and description, with one print taken from each scene or act if the work be a motion-picture photoplay; or of a title and description, with not less than two prints taken from different sections of a complete motion-picture, if the work be a motion picture other than a photo play. The amended act also provides that in the case of the infringement of an undramatized or non-dramatic work by means of motion-pictures, where the infringer shall show that he was not aware that he was infringing, and that such infringement could not have been reasonably foreseen, such damages shall not exceed the sum of one hundred dollars; and in the case of an infringement of a copyrighted dramatic or dramatico-musical work by a maker of motion-pictures and his agencies for distribution thereof to exhibitors, where such infringer shows that he was not aware that he was infringing a copyrighted work, and that such infringements could not reasonably have been foreseen, the entire sum of such damages recoverable by the copyright proprietor from such infringing maker and his agencies for the distribution to exhibitors of such infringing motion-picture shall not exceed the sum of five thousand dollars nor be less than two hundred and fifty dollars. It is also provided by the act that the foregoing exceptions shall not deprive the copyright proprietor of any other remedy given him under this law, nor shall the limitation as to the amount of recovery apply to infringements occurring after the actual notice to a defendant either by service of process in a suit or other written notice served upon him.

Dry Cleaner for Windows, Mirrors, and the Like

IT is frequently desirable to clean glass in windows, mirrors, picture frames, show cases, and the like, without the use of water or other liquids which are liable to drop or be spattered in the operation. An inventor has recently hit upon the scheme of cleansing the window with a dry cleansing material, which is rubbed



Dry cleaner for windows, mirrors and the like.

over the glass and which removes all dirt from the surface. The cleansing material is placed on a band of cloth supported in a frame similar to that shown herewith. The cloth band is wound on two rollers and may be fed from one to the other whenever it is desired to bring a fresh surface into play. At the point of application the cloth passes over a felt-covered plate. Directly back of this plate is a knife, which may be used for scraping such particles of dirt as adhere very strongly to the glass. With this device the glass can be cleansed without the use of any liquids.

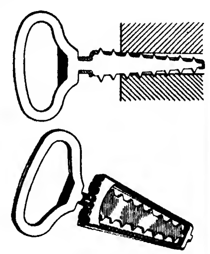
Starting an Engine Pneumatically

JOHN A. HEANY, Washington, D. C., has secured a patent, No. 1,029,994, for an apparatus in the nature of an engine starter which includes, in connection with a pressure tank, a pneumatic appliance which is convertible from a motor to a pump and is located between the pressure tank and the engine shaft. Differential gearing is provided between the tank and the shaft and automatic clutches for the gearing, and means are provided for automatically throwing out the pumping gearing and locking such gearing out of action in order to convert the apparatus into a motor upon the attainment of a predetermined pressure in the tank. Thus, in operation, the pump acts to produce pressure in the tank and then when a certain pressure is attained the pump is thrown out of action and the apparatus is converted into a motor which can be utilized to start the engine.

A pocket typewriter of the form and size of a big watch.

Door-fastening Device

EVERY now and then a patent is issued upon an emergency device for locking doors, which would seem to indicate that there is a considerable demand for such an appliance. No doubt travelers frequently find themselves in hotel apartments inadequately equipped with locks. Under such conditions it would be convenient to have a pocket device for securing the door against intruders. The accompanying illustration shows a door securer consisting of a flat key formed



Door-fastening device.

with sharp teeth along each edge, and mounted to turn within a yoke. The key is turned to the plane of the yoke, and inserted between the door and the jamb. Then it is turned crosswise to wedge the sharp teeth into the wooden door and its frame. It is impossible to open the door under such conditions without tearing out the wood engaged by the teeth of the key.

A Pocket Typewriter

THE adoption of typewriters has within a few decades revolutionized the whole of office management and practically supplanted handwriting for commercial and official use.

Recent inventors seem, however, not to be content with this widespread success of the writing machine but wish to extend its use even further. These endeavors have on one hand resulted in the production of exceptionally light typewriters reduced to minimal dimensions, which can be readily carried about when traveling, and on the other hand in the invention of cheap typewriters suitable for those whose correspondence is too limited to warrant the purchase of a standard machine.

One of the most notable productions in this line is the pocket typewriter invented by Mr. Albert Fink. This has the form and dimensions of a big watch comprising on its dial the letters of the alphabet, the numerals and the signs. Its manipulation is extremely easy, the whole machine being slightly pressed against the paper after the proper letter has been adjusted for. After printing a letter it advances one space along the rack traversing the watch-like attachment, which also carries at its back edge the paper to be typed on. With some practice one gets up a certain, though of course modest, speed.

The whole arrangement is extremely simple and the price of course only a small fraction of the cost of even the cheapest regular typewriter. The principle used in connection with this machine is the same as that on which the very first typewriters were based.

Notes for Inventors

Protection of Metal Against Rust.—It is possible that some day, some one will invent or produce some means or method, or both, of preventing the destructive rusting of iron and steel embedded in the earth. Such an invention should be profitable, as it would make permanent and everlasting millions of tons of metal, which, under present practices, must be replaced after a few years use.

A Paper Stencil.—Sterling Elliott of Newton, Mass., in patent No. 1,034,600, shows a simple stencil strip from which stencils may be cut. It consists of a folded strip of paper with holes arranged in pairs so they will register when the strip is folded and a second strip of paper arranged between the folds of and pasted to the folded strip with both strips solidified and stiffened by the same adhesive substance.

Churning Butter by Air Currents.—A method of producing butter has been patented to Alpheus Fay of Louisville, Kentucky, No. 1,034,350, in which ebullition is produced in the body of the milk by the tangential collision of two volumes of air, the vessel having unobstructed concave walls. The ebullition is produced for a period of from 30 to 60 seconds.

Milking by Pedal.—A new milking machine was recently exhibited at the Royal Show at Doncaster, England, and attracted much attention. The feet instead of the hands are used for milking. The operator sits on a tricycle seat and pedals, drawing the milk from two cows simultaneously. Twenty to twenty-four cows can be milked in an hour by one milker with a cowman in attendance.

A Sound Muffler for Telephone Booths.—In patent No. 1,033,963, Edwin M. Surprise of Boston, assignor to American Telephone and Telegraph Company, presents a telephone booth having a ventilating tube so formed as to muffle the sound from within the booth. In the construction shown in the patent, the tube is provided with slots and with baffle plates secured in the slots and projecting partly across the tube and having flared edges over which the air current passes.

Why Not a Trunk Carrier?—Have you ever noticed the terrible strain upon the men who carry heavy trunks up and down stairs on their backs? Trunks do not seem to decrease but rather to increase in size. Surely there must be a limit to human endurance. It is in order for someone to devise a means whereby the transfer man will be relieved of some of his burden.

Trade-mark Notes

"Boy Scout" Not a Registrable Trade-mark.—Commissioner Moore in the case of *ex parte* Warner has held that the words "Boy Scout" are not registrable as a trade-mark for leggings, gloves and mittens, since as applied to such goods the mark is either deceptive or descriptive.

"Hygeia" as a Trade-mark.—Assistant Commissioner Tennant has held that the word "Hygeia" as a trade mark for coffee is not descriptive. The decision was rendered in the case of Levering Coffee Company v. Merchants' Coffee Company.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Pertaining to Apparel.

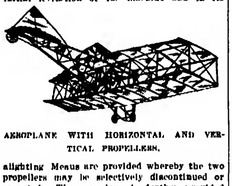
COLLAR AND TIE RETAINER.—C. A. BARNES, Missoula, Mont. This invention relates to a retaining attachment for turn-down cloth collars, and is designed to engage positively with both the ends of the collar and the tie of the wearer in order to hold them in proper position relatively to each other

Pertaining to Aviation.

FLYING MACHINE.—C V JOHNSON, Goldfield, Nev An object of this inventor is to provide a flying machine in which the main supporting surface is provided by means of a plurality of individual planes capable of pivotal movement and having their pivotal axes arranged on a diagonal, so as to vary the angle of the incidence

FLYING MACHINE J MALJKOVICH, 2480 8th Ave, Manhattan N Y, N. Y. The principal object here is to provide a form of machine having planes thereon which extend on opposite sides of the frame of the machine, each of these planes being curved in cross section, together with ailerons pivotally carried at the outer end of each of the planes, the ailerons being plane in cross section

AEROPLANE.—ALBERT E PETRUCCI, 1208 Clay Ave., Bronx, New York The aeroplane invented by Mr Petrucci has, in addition to the ordinary propeller, a horizontal propeller mounted above the pilot's head This horizontal propeller may be used to assist in the initial levitation of the machine and in its



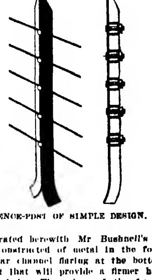
AEROPLANE WITH HORIZONTAL AND VERTICAL PROPELLERS.

alighting Means are provided whereby the two propellers may be selectively discontinued or operated The aeroplane is further provided with steering apparatus adapted for operation to alter the line of flight It carries planes that operate as self-righting members to preserve the equilibrium of the machine in air The perspective view is of the aeroplane as seen from the rear.

Of Interest to Farmers.

ALARM FOR INCUBATORS AND BROODERS.—J. TRAPP, R F D No. 5, Valley Falls, Kan The aim of this invention is to provide an alarm which in the event of a variation in the temperature within the incubator will be automatically sounded, notifying the attendant, who may at once give the necessary attention thereto as the conditions may require

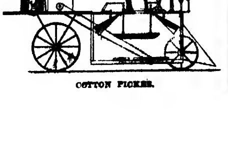
FENCE POST.—PORTER KINNE BUSHNELL, Box 121 R. F. D. No. 1, Medina, New York.



FENCE-POST OF SIMPLE DESIGN.

As illustrated herewith Mr Bushnell's fence-post is constructed of metal in the form of an angular channel flaring at the bottom to form feet that will provide a firmer hold in the post hole The wires of the fence are caught in notched bolts which pass through the corner of the fence-post and through blocks of triangular form fitted against the rear side of the post

COTTON PICKER.—H SKAER, Tamaroa, Ill This cotton picker is arranged to readily remove or pick the ripe bolls of cotton from the plants without danger of injuring the



COTTON PICKER.

foliage or blossoms, and permits of repeated use to gather all the bolls as they gradually ripen from the plants upward to the top thereof. For this, use is made of air propellers arranged to pass along the lower portions of the plants and forcing an air blast upwardly against the bolls to detach the same from the plants, and a conducting tube above the plants for receiving the detached bolls. The engraving represents a longitudinal central section of the picker.

MILKING MACHINE.—O. C SIBILSKY, Algoma, Wis The invention pictured in the illustration in actual use, provides a machine which will cause the milking operation to be performed by compression rather than by suction or stripping, provides a device detachable so as to accommodate it for use in con-

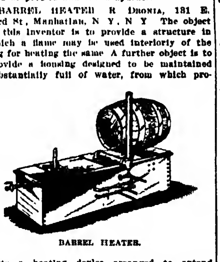
MILKING MACHINE.

nection with different size cows or those having different size udders; provides an actuator for the milker which is adjustable in accordance with the size of the teats, and provide a milking machine in which the compression cups are formed and operated so as to simulate the form and operation of a person's hand in hand milking

Of General Interest.

FOOD PRODUCT P. H MENTZ, 714 Hennen Bldg New Orleans, La. This invention has reference to certain improvements in food products for animals, and the object of the invention is to provide a food product of a palatable nature and containing high percentages of protein and carbo hydrates

BARREL HEATER R DRONIA, 131 E. 83rd St, Manhattan, N Y, N Y The object of this inventor is to provide a structure in which a flame may be used interiorly of the keg for heating the same A further object is to provide a housing designed to be maintained substantially full of water, from which pro-

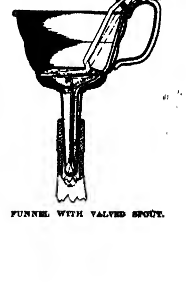


BARREL HEATER.

jects a heating device arranged to extend through the bunghole of a keg or barrel so that when the rosin or pitch in the keg or barrel has been melted the same will pass out the bunghole into the receptacle or reservoir and will be chilled by the water so as to quickly coagulate or solidify A perspective view is herewith given of the invention showing a keg in position

SPOOL HOLDER.—C KAMP and E. SCHOPPE, 93 Columbia Ave., Jersey City, N J. The purpose of his improvement is to provide a holder arranged to permit the user to conveniently unwind a desired thread from its spool without danger of entangling the thread, and to allow of readily cutting off the length of thread unwound from the spool.

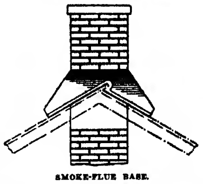
FUNNEL.—JOHN J LACY, 370 New Street, Perth Amboy, N J When a common funnel is used in filling a bottle and more liquid is poured in than the bottle will hold it is impossible to save that liquid which remains in the cup of the funnel. When the funnel



FUNNEL WITH VALVED SPOUT.

is removed the liquid pours out and is lost. The present invention provides a valve at the lower end of the funnel tube which is operated by a handle or hand lever projecting from the cup of the funnel. The valve may be kept open by means of a catch which holds the valve hand lever in the dotted position. When the funnel is removed from the bottle the catch is released permitting the valve to close under the action of a leaf spring.

SMOKE-FLUE BASE.—W. A. DECK, 105 Buena Vista St., Newark, Ohio. In carrying out the objects of the improvement, a single block is cast of concrete or constructed in any desired manner, arranged with a projecting lower portion for engaging the interior part of the chimney, and an upper squared portion for engaging the exterior part of the chimney. Radiating from the upper part of



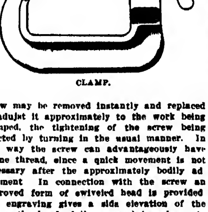
SMOKE-FLUE BASE.

the block is a substantially circumferential flange which defines a pair of over-hanging members designed to thoroughly protect the opening in the roof through which the reduced part projects. The side view presented is an embodiment of the invention shown applied, part of the chimney and part of the roof being shown in connection therewith.

SPRAYING COMPOUND MIXER.—N. J. WIGGINTON, Winchester, Va. This inventor provides a device in which substances such as sulfur and lime may be mixed with water so as to insure the production of a homogeneous substance. Also a device which will automatically mix the ingredients of the spraying solution, said device being provided with arms or scrapers which tend to scrape solid portions of the mixture toward the central part of the device, thereby preventing the clogging of the device.

Hardware and Tools.

CLAMP.—J. VANDENBURG, R F. D. No 2, Cortland, N. Y. This invention comprises a substantially U-shaped frame, with a thumb screw mounted in one arm of the frame and movable toward and from the other arm. The arm carrying the screw has a special formation to constitute a split nut, so that the



CLAMP.

screw may be removed instantly and replaced to adjust it approximately to the work being clamped, the tightening of the screw being effected by turning in the usual manner. In this way the screw can advantageously have a fine thread, since a quick movement is not necessary after the approximately bodily adjustment In connection with the screw an improved form of swiveled head is provided The engraving gives a side elevation of the clamp, the head of the screw being shown in section.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.
MUNN & CO., INC.

Inquiry No. 9255. Wanted to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No 9256 Wanted addresses of parties having Pitchblend deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258 Wanted addresses of parties having gem materials to offer any part of the world.

Inquiry No. 9259. Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260. Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

Inquiry No. 9261. Wanted a manufacturer to make card games.

Inquiry No. 9262. Wanted to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Inquiry No. 9263. Wanted name and address of manufacturer of pantaloon stretchers with clamps, which is capable of being folded up.

Inquiry No. 9264. Wanted the name and address of manufacturers of date pitting machines.

Inquiry No. 9265. Wanted the names and addresses of manufacturers of machinery for making picket fences.

Inquiry No. 9266. Wanted to buy machinery for fastening wire cloth to wooden frames with coppered tacks.

Inquiry No. 9267. Wanted addresses of manufacturers of metal specialties in connection with plate or window glass.

Inquiry No. 9272 Wanted names and addresses of engravers and mounters of fine quality maps or plans of large cities. Large order.

Inquiry No. 9273. Wanted to buy a globe for a parlor fountain, working on the Heron system.

Inquiry No. 9274. Wanted the name of a manufacturer of a machine to make cushion covers for fruit crates.

Inquiry No. 9275. Wanted name and address of manufacturer of stock patterns of plates for printing presses.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12683) J. E. G. asks: 1. Is it not possible to counteract the poison of venomous serpents by the stinging of many bees in the vicinity of the wound? A We are not an authority upon antidotes for serpents' bites. Your proposition to use the stinging of bees for this purpose seems to be good homeopathic doctrine, but we cannot give judgment in the case. 2. Is it not possible that the crossing of our northern mosquito with the tropical breeds will produce a species that will not survive our winters? A. Probably a cross among species of mosquitoes would produce a variety which could be frozen out in winter, but we do not see how the addition of one more breed would kill off the breeds we now have. This pest has been found in every latitude and in most longitudes, and the best remedy for it would seem to be to kill it on the spot where it is found. Our scientists tell us it does not wander far from its birthplace, and if exterminated in any locality, that locality can easily be kept free from its ravages.

(12684) E. G. S. asks: I came across an article the other day entitled "Great Step in Electroplating." Two Italian chemists have invented a process for electroplating china, wood, glass, etc., which are non-conductors of metal, with copper, silver, gold, etc. Can you give me any information about it? Do you know who the chemists are and what the process is? A. We have not seen the article on a "Great Step in Electroplating," to which you refer, and cannot say what there is which is *new* in it. But we saw glass electroplated with copper about 1880, and even the tender petals of flowers have in more recent years been electroplated so that hatpins and other articles have been ornamented with metal roses and pinks, made by plating the real flower which was still inside the metal covering. The process was fully described in the SCIENTIFIC AMERICAN, vol. 99, No 22. Valuable papers about electroplating on wood and other non-conductors may be found in the SCIENTIFIC AMERICAN SUPPLEMENT, Nos 1190 and 1204, and in the SCIENTIFIC AMERICAN, vol. 106, pages 220 and 243 We will send the five papers for fifty cents We regret that we have not the specific information you request, but hope that you may find in our references equally good processes for reaching the same results

(12685) A. N. H. asks: 1. Is the old theory that there is no sound unless there is someone there to hear it, correct? A. The statement you quote about sound is a psychological one Sound is to the psychologist a sensation in the nerve centers. Apart from the auditory nerve and the brain there is no sound. To the physicist sound is such a rate of vibration of ponderable matter as is able to excite the auditory system The vibration exists whether there is a nerve to receive it or not. The dictionaries define sound in both these senses. It is necessary to discriminate the sense in which the word is used. Both are correct 2 How do we locate sound, or its starting point, from a few feet to a mile or even two miles away? A We locate a sound by our sense of direction, which we exercise by turning the ear to different directions and judging of loudness and distinctness. If the sound has been reflected, we can only determine the last direction in which it traveled. Its loudness will be that which is due to the total distance over which it has passed. 3. What do we get over a telephone, say, a hundred and fifty miles away, when we can recognize plainly the voice of some friend? A. Over the telephone line only a current of electricity passes from transmitter to receiver, even a thousand miles away. The voice speaking into the transmitter, as it were, carves and forms the telephonic current into a wonderful shape peculiar to the voice of the speaker. At the receiver this current causes vibrations in the diaphragm of sheet iron, which produce sounds identical with those spoken into the transmitter a thousand miles away. It is wonderful, magical. In all the intervening distance there is no sound, no motion of matter, only the pulsation of the ether of space which we call a current of electricity. 4. How much power is there in a spring similar to a watch or clock spring, proportionately the same, only a good deal larger, say, for instance, a spring four inches wide? Would there be a horse-power in it, more or less? A. The power which can be obtained from a spiral spring such as is used in a watch is measured by the weight it can lift. If it can lift one pound one foot in one second, its power is one foot pound per second. If it could lift 55 pounds 10 feet in a second, it would have one horse-power. What power a spring four inches wide could exert would depend largely upon the quality of the steel and the thickness of the metal. Data for various springs are given in Kent's "Mechanical Engineers' Pocket Book," which we can send for $5.00.

NEW BOOKS, ETC.

Microbes and Toxins. By Dr. Etienne Burnet of the Pasteur Institute of Paris. With a Preface by Elie Metchnikoff. Translated from the French by Dr. Charles Broquet and W. M. Scott, M.D. Illustrated. New York: G. P. Putnam's Sons, 1912.

In a gracefully worded introduction Prof. Metchnikoff informs us that of all his staff he considers Dr. Burnet one who is most admirably fitted to write this book. Dr. Burnet has acquitted himself with credit. He has given us a wonderfully compact, instructive, well-written book on the chief problems that confront the modern bacteriologist. Although there is much in the book that would appeal more to the technical bacteriologist than to the ordinary lay reader, it must be confessed that it lends itself well to the purposes of the general reader who is seeking some explanation of the work that the modern bacteriologist is doing in discovering the effect of microbes on the world in which we live.

Evolutionary Biology. By Arthur Dendy, D.Sc., F.R.S., Professor of Zoology in the University of London. New York: D. Appleton & Co., 1912. 8vo.; 454 pp.

This book is intended to be of use to those who have had no special biological training as well as to students who are taking the ordinary first year's course. Accordingly, in the earlier chapters the author has dealt in a very elementary manner with the structure and functions of both plants and animals. The type system has been altogether discarded as unsuitable for a work of this kind, although of course the author has been obliged to refer to numerous different organisms in illustrations of special points. Although the entire work is intended to be of an elementary character, it has been impossible, in connection with the theory of heredity, to avoid, on the one hand, a considerable amount of cytological details, and, on the other, some discussion of theoretical speculation of a highly controversial nature. In dealing with these controversial questions, which underlie the whole problem of organic evolution, the author has endeavored to present the views of opposing schools of thought as clearly as possible, but he freely expresses in his preface that he has ventured to lay considerable stress upon ideas which, though widely accepted elsewhere, have not as yet met with much appreciation in England.

Commercial Engineering for Central Stations. By Arthur Williams and Edmund F. Tweedy. New York: The McGraw-Hill Book Company, 1912. 8vo. Price, $2.50.

Mr Williams is past president of the National Electric Light Association and a member of the American Institute of Electrical Engineers, a man whose business career has been identified almost entirely with the electrical industry. Mr. Tweedy is a commercial engineer of repute. Together these men have given us a work which must surely be of immense value to those who guide the destinies of central stations. The book serves the useful purpose of showing how central stations may widen the field of application for current. Of the scope of the book, some idea may be obtained from the following chapter headings: I. Estimating the amount of coal required to heat a modern city building. II. Cooling the air of buildings by means of mechanical refrigeration. III. Mechanical refrigeration for the cold storage of furs and fabrics. IV. The application of mechanical refrigeration to ice-cream making. V. The cost of generating electrical energy in steam-driven central stations of small and of medium size. VI. Kilowatt-hour costs in steam-driven generating plants. VII. Central station load factors. VIII. Electricity in the modern department store. IX. The passenger elevator in office building service. X. Ozone: its production and utilization. XI. The use of electricity for the disinfection of sewage.

The Elements of Statistical Method. By Willford I. King, M.A. New York: The Macmillan Company, 1912. 12mo.; 250 pp. Price, $1.50 net.

There seems to be a distinct field for a text-book of this nature, and the author is to be congratulated on the manner in which he presents his subject. He is correct in his assumption that most of those called upon to make practical use of statistics are by no means expert mathematicians, and the work in hand keeps strictly to the simpler, basic theorems of statistical method. The first division of the book is introductory and explanatory. The second division deals with the determination of the statistical unit, the collection of data, approximation and accuracy; the third takes up the problems of tabulation, diagrams, types and averages, dispersion, and skewness. The fourth and final division presents various methods of comparison, correlation, and the ratio of variation. Some valuable appendices complete the work.

Naturformen. 1. Serie: Mikroskopische Vorbilder, Kristallformen. Von H. Schenk. Neue Formen fuer den Ornamentiker. Ausschnitte aus der schaffenden Natur in einer Fuelle eigenartiger, ewig wechselnder Motive. Stuttgart: Geschaeftsstelle des Mikrokosmos-Franckh'sche Verlagshandlung.

This series of admirably reproduced micro-photographs of crystals, etc., is intended to be of service to the designer of textiles, ceramics, graphics and the like, by suggesting new designs. There can be no doubt that a series of [illegible] value.

The Gordon Bennett Contest

(Concluded from page 246.)

minium to cleave the air with minimum resistance.

The bow of the Deperdussin monoplane seems excessively blunt to be of good stream-line form. This might be remedied by more pronounced tapering of the wind shield jutting before the propeller. Unfortunately, the revolving cylinder motor, with its outer diameter of 34½ inches, seems necessarily to imply a large body resistance. With a water-cooled motor entirely housed in a well-tapered bow, and with the radiator surface on the outer side of the hull, the body resistance might be much reduced. There seems, therefore, to be much improvement possible in the aerodynamic features of this machine. But even as it stands, Vedrines predicts that by using his smaller racing wings he will be able to attain a speed of 125 miles per hour. He did not use these small wings because he was not pressed by serious competition in the race.

Little need be said of the 100 horsepower Deperdussin piloted by Prevost, except to note that its average speed for the entire course was 100.05 miles per hour, as against Vedrines' record of 105.5 miles an hour. The propeller measured 2.40 meters in diameter by 2.60 meters pitch. In general appearance and in structure and control, it was like the higher-powered machine.

The Hanriot 100 horse-power monoplane, piloted by Frey, bears a very close resemblance to the well-known Nieuport, with its quadrangular-sectioned fuselage, its peculiar form of wings and its landing chassis. But it has too much resistance, and is too slow for the best speed. When overhauled in its course by the smaller Deperdussin, their difference of speed was very manifest to the eye.

The result of the contest, while somewhat disconcerting to Americans, will, it is hoped, benefit them. The wonderful flying of the French airmen, and the helplessness of the Americans with their untried and hurriedly-built monoplane, proved a dramatic and severe lesson on the need of scientific and systematic preparation, as well as of effective team play. If the contest had been waged for command of the air against a great military power, such defeat would have been sad.

Vedrines affirms that the greatest difficulty confronting the designer of racing aeroplanes is to provide for safe landing. Even at his present speeds he thinks the landing too dangerous. He contemplates a design which will admit rising and landing at moderate velocities while allowing much greater speeds well above the ground. The problem is to adapt the wings to lift the machine at moderate speeds and again no more than just sustain it at the maximum speed in regular flight.

Playing Polo With Stripped Cars

IN Wichita, Kans., a number of expert automobile drivers indulged in a game of polo recently, in which the part of the ponies was taken by stripped motor cars. The game was played in three 10-minute series, to a 1-1 tie score. The goals were 60 feet apart, and in the whirlwind driving one of the cars turned a complete somersault, without, however, injuring anybody.

Popular Flying Machine Subscription in Italy

BY popular subscription funds have been placed at the disposal of the Italian government for the donation of a fleet of one hundred aeroplanes. All told there are about ten aeroplane factories in Italy. Some of them would undoubtedly profit by this popular interest in the military aspect of aviation.

The Motor Truck Department

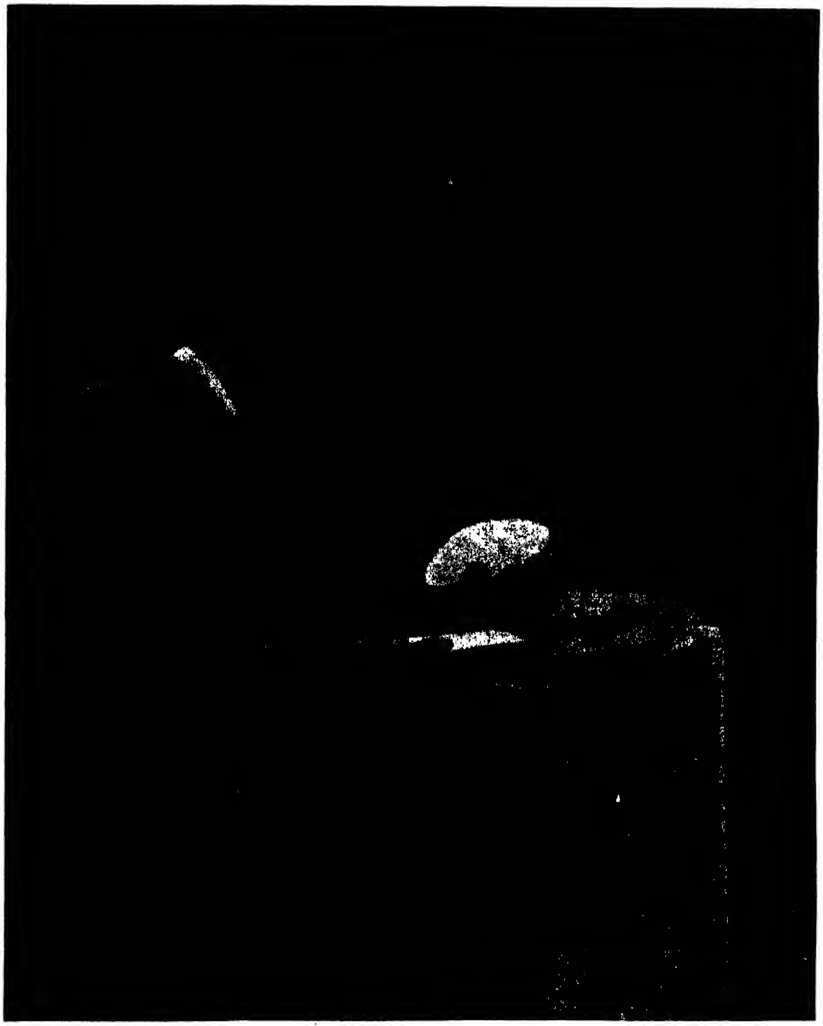
IT has been found necessary to postpone the Motor Truck Department which was advertised for the present number. The first issue of the Department will appear in the SCIENTIFIC AMERICAN of September 28th, 1912.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 13.] NEW YORK, SEPTEMBER 28, 1912. [PRICE 10 CENTS $3.00 A YEAR



BESSON'S NEPHOMETER

A new instrument for measuring the cloudiness of the sky.—[See page 256.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, SEPTEMBER 28, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer,
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid, ...	3.75

The Scientific American Publications

Scientific American (established 1845) . . . . per year,	$3.00
Scientific American Supplement (established 1876) . "	5.00
American Homes and Gardens . . . . "	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

America and the Gordon Bennett Cup

OUR request for correspondence on the question of the causes of our inability to make any defense of the Gordon Bennett Cup has met with a quick response from one who is pre-eminently qualified to speak with authority on this subject. Mr. Charles M. Manley, whose letter appears on another page, was the engineer associated with Langley in the classic experiments in flying made over the Potomac River. His contention that the difference between American and French machines is largely one of the degree of excellence of workmanship, comes with particular force from the man who designed and built the beautiful and extremely light motor for the Langley aerodrome, which is at present in the Smithsonian Institution, Washington. Mr. Manley asks: "Is not the progress which our inventors and builders have made in hydro-aeroplanes fully as important as the more spectacular achievements in speed?" Undoubtedly, next to the work of the Wright brothers in giving birth to the man-carrying motor-driven aeroplane, that of Curtiss, in producing the first practical hydro-aeroplane, is the most important contribution to aviation, certainly in this country and possibly in the whole world. Mr. Manley evidently considers the dearth of capital in the aeroplane industry is not chargeable so much to the capitalist as it is to the United States Government. That is to say, if our Government provided appropriations of a sufficient amount to justify the manufacture of aeroplanes on a liberal scale, just as the French government has been doing, it is probable that capital would regard the aeroplane industry as an attractive field for investment.

Good Rails and the Rail Mills

WE commend for careful reading the letter, which will be found in our correspondence columns, from an authority on the subject of steel manufacture, dealing with the subject of the manufacture of reliable steel rails. By way of comment on Mr. Wellman's letter, we invite attention to the following facts.

As a result of the alarming increase in rail failures which occurred a few years ago, the subject was taken up by the American Railway Engineering Association, who formed a committee composed of eminent railway engineers and representatives of the rail manufacturers, which was instructed to make an exhaustive investigation. The report of this committee was recently made public. A careful reading of this report, and particularly of the papers presented in this city at the recent International Congress for Testing Materials, points to the following conclusions:

The claim of the railmakers that a reasonably high percentage of carbon is responsible for piping and the breakage of steel rails is not established by the latest expert evidence.

R. Trimble, Chief Engineer of Maintenance of Way, N. W. System, Pennsylvania Lines, as a result of an investigation of statistics from eighty-four railroad companies, relating to 12,893,007 tons of rail failures, finds that "difference in carbon does not account for variation in rate of failure." This statement was borne out by a confidential report of one of the largest railroad systems in the country, in which there appears the following conclusion based on a study of failed rails on that system for a period of three years: "Increase of carbon has not caused an increase of rail failure due to brittleness, but the reverse."

Although Mr. Wellman is undoubtedly correct in stating that a liberal discard (cutting off of the inferior top of the ingot) will not entirely remove all piping, it cannot be denied that the chance of having defects in finished rails is much reduced by a liberal discard. This is shown by the paper of J. R. Onderdonk, Engineer of Tests, Baltimore and Ohio Railroad System, in the same report of the Committee on Rails: "Being one of a committee to investigate this subject in 1905," he says, "we visited the different rail mills and were told that this defect—split rails—was due wholly to not having had the proper top discard;" and at the conclusion of his paper, he says: "The blooms should be cut back until solid metal is reached; which does not seem to be accomplished with the present method of shearing," in which a uniform percentage of discard is used for all ingots irrespective of their quality.

That alloy steel will solve the question of proper rail manufacture is not only open to doubt, but the tests so far made have proved that any improvement in some directions from the use of alloys may be more than compensated by troubles in other directions. The chief engineer of one of our leading railroads informs us that he found nickel steel, for instance, to be unreliable. On the subject of titanium steel, of which we hear so much to-day, we have, as a guide, the recent investigation made by M. H. Wickhorst, Engineer of Tests, Rail Committee, dealing with the subject of pipeless ingots. In his summing up Mr. Wickhorst says that "while the use of one tenth of one per cent or more of metallic titanium prevents the honeycombed conditions; . . . it is also attended with larger and deeper pipe. . . . Large internal flaws were found in rails considerably lower down from the top of the ingots in steel treated as mentioned, than in rails made from plain steel."

That the use of heavier rails will be a cure for breakages is disproved not only by the wide experience of American engineers, but by the report already mentioned on the investigation of over ten million tons of broken rails, among the findings of which we notice this: "The average performance of the heavier sections is not so good as the average performance of the lighter sections," which to our mind is at least a suggestion that the lighter rails of an earlier date of manufacture were made with less haste and greater care.

That the railroad companies are sincerely desirous of obtaining a higher quality of rail, even at a higher cost, is shown by the widespread advocacy of Open Hearth in preference to Bessemer rails. The superiority of the Open Hearth product is generally acknowledged among railroad engineers. Thus the report of the Committee on Rails says in its conclusion: "The Open Hearth rail as a whole shows a lower rate of failure than the Bessemer."

Summarizing the findings of the Rail Committee's report, and of the excellent articles presented at the recent congress in this city, there seems to be a general consensus of opinion at the present time that the question of such details as chemical composition, section and weight of rail, use of alloys, and the nature of the track maintenance, are subordinate to the greater question of uniformity of product and the general character of manufacture at the rail mills. The SCIENTIFIC AMERICAN is still of the opinion that the question of securing sound rails is a question of greater care and less hurry in the process of manufacture. Improvement should be in the direction of cutting off from the ingot all that part of it which contains segregated material and piping, the casting of smaller ingots; and the more thorough working of the metal during the process of rolling. The Germans have shown us that, at some increase in the cost, piping may be practically eliminated. Why have our rail manufacturers not taken cognizance of their methods?

The whole subject of method of manufacture was excellently summarized in the letter of Mr. Richards, Chief Engineer of Maintenance of Way of the Pennsylvania Railroad, of June 22d, 1911, addressed to the American Railway Engineering Association. He believes that a good rail can be made "if the mill practice is right." This opinion was reiterated at the recent congress by Robert W. Hunt, president of the American Society for Testing Materials, who protests against the present method of using large heats of 100 tons, and expresses his belief that "if a positive necessity for sound ingots be commercially established, a commercial way to produce them will be found."

Gyroscopic Action in Aeroplanes

THE question of the effect of the revolving motor upon the equilibrium of the aeroplane is again brought up by the letter of Mr. Brooke published in our correspondence columns. Although the subject has already received considerable attention, even to the extent of having been made the subject of investigation by the French builders of revolving motors, it has been suggested that the matter should be taken up by a committee of impartial investigators and made the subject of exhaustive tests. Theoretically, gyroscopic effects should exist; indeed, the makers have admitted that there are such effects; though they affirm that they are of so slight a character as not to constitute a source of danger. According to our correspondent, the late Paul Peck admitted that he had been troubled, though not to any serious extent, by this action. Evidently, in common with Earle Ovington and other successful flyers, he did not consider that gyroscopic action was of sufficient violence to endanger the stability of an aeroplane in flight. It is conceivable, however, that although the effect is negligible in calm weather and during normal flying, it might prove to be the last straw in producing an upset, due primarily to other and larger disturbing influences.

The Nature and Origin of Life

THERE are problems in science which are essentially modern, and which could not have been even conceived in the minds of the ancients. There are other fundamental problems, which have exercised the minds of thinkers of all ages, and which still remain to baffle the most advanced workers in the fields of modern science. Of such is the problem of the nature and origin of life, selected by Prof. E. A. Schaefer as the topic for his inaugural address before the British Association at Dundee, which we present in abstract on another page of this issue.

All attempts to "define" life are more or less failures. "The ordinary dictionary definition of life is 'the state of living.' Dastre, following Claude Bernard, defines it as 'the sum total of the phenomena common to all living beings.' Both of these definitions are, however, of the same character as Sydney Smith's definition of an archdeacon as 'a person who performs archidiaconal functions.'"

The fact is that such attempts are based upon a logical blunder: the fact that a certain word has come into general use in popular language, does not in any way guarantee that there exists a corresponding objective counterpart. If an example is necessary to illustrate this, we need only remind the reader of the word "ghost." Some of us may "believe" in ghosts, but at any rate their existence is not proved. Similarly, to argue that because the word *life* exists, therefore it must be possible to precisely define a certain objective and clearly circumscribed set of phenomena corresponding to that term is fallacious. This would imply that those who, ages ago, first framed the word *life*, in some way possessed an intimate knowledge of these phenomena—a knowledge which we in our day are far from being able to claim. Prof. Schaefer is careful to avoid entanglement in hopeless "philosophical" quibble. He attempts no definition of life, but dismisses this point with the words: "I am not myself proposing to take up your time by attempting to grapple with a task which has proved too great for the intellectual giants of philosophy, and I have the less disposition to do so because recent advances in knowledge have suggested the probability that the dividing line between animate and inanimate matter is less sharp than it has been regarded, so that the difficulty of finding an inclusive definition is correspondingly increased."

Dropping Bombs on Balloons and Targets

THE recent events at Gotha showed that bomb-dropping from aeroplanes is not an easy matter. Prizes of $2,500, $1,000 and $400 are awarded to pilots who fly at 660 feet height and drop the greatest number of bombs in a square of 330 feet, as we already mentioned. The target represents a military bivouac. Two prizes of $750 and $400 are awarded for dropping bombs upon a captive balloon anchored near the ground, the aeroplanes to fly at 165 feet at least. During the events the first pilot to try his skill was Hanuschke, but he was not able to place any of the bombs upon the captive balloon, which had the form of a Zeppelin. Lindpaintner then made a flight, and when at 800 feet height he dropped bombs upon the 330 feet square target and was able to place seven of these in the mark. After an attempt made by Kaspar, whose aeroplane made a bad landing and was smashed to pieces, Palmerburn flew with his machine and dropped three bombs, but only one of these hit the mark. Beil dropped two projectiles, placing one of them inside. A Jena establishment has designed and built a sighting device which is composed of a telescope, a graduated scale and a watch. After reckoning the approximate speed of the aeroplane or airship, its height, and also the height of the target with reference to the sea level by the use of a map, the pilot, taking the speed of the wind into account, sights the object by the telescope, and lets the bomb drop by means of a lever.

Engineering

The Madeira-Mamore Railway, the construction of which has perhaps attracted more attention from the world at large than any other railway enterprise in South America except the Transandine, was opened at Porto Zelho on September 7th, 1912.

Terminals for the State Canal.—The New York State Canal Terminal Commission has adopted plans for an extensive system of docks, piers and warehouses, along the State Barge Canal, the total cost of which will be about $20,000,000. At New York it is proposed to have terminals connected with the projected elevated freight railroads along the Hudson River, Manhattan Island, which is advocated by the present Dock Commissioner.

Lake Submarines for the Navy.—The Lake submarine, built for the United States Navy, has recently undergone successful trials, in which she exceeded every contract requirement. Her surface speed was 14.7 knots, and submerged, just under 11 knots. She was run over the mile course at a predetermined depth from which she did not vary two feet. This vessel holds the record for deep submergence, having reached a depth of 266 feet with her crew aboard.

The Turbines of the "Neptune."—We are informed that the trouble with the "Neptune," which, by the way, has not been rejected by the Government, is that the turbines were over large for the work they had to do and therefore did not show the economy which had been expected. The "Neptune" is to be taken over by the Government, and orders have been issued to put the vessel into commission and run her until the new, high-speed marine turbines, which are being built by the contractors for the ship, are ready.

Trackless Trolleys on Long Island.—We understand that plans have been consummated for the use of the trackless trolley at Flushing, Long Island. The trackless trolley was first successfully introduced in Germany, at which time it was illustrated and described in our columns. The main advantage of the system is the saving of cost due to the elimination of the tracks, and the great flexibility of operation, the whole width of the highway being available for all vehicular traffic, whether horse-drawn or motor-driven.

Locomotives as Fire Engines.—Ten years ago the Pennsylvania Railroad commenced to use railway locomotives as fire engines. To-day there are 612 engines in yard and switching service equipped with special fire-fighting apparatus. The standard equipment for each locomotive consists of 160 feet of 2½-inch hose and a 15-inch cast iron nozzle with a ⅝-inch discharge opening, kept in a box under the running board of the engine. With this equipment engines can throw a stream of water 70 feet. The water is drawn from the tender and is discharged through an ejector by steam from the locomotive boiler.

A 36-knot Destroyer.—The Russian destroyer "Norik," according to *Engineering*, is stated to have exceeded 36 knots on her official trials last month The vessel, which is 336 foot long by 31 feet 6 inches beam, is of 1,280 tons displacement, and was built at St. Petersburg, the machinery consisting of A. E G turbines and oil-fired boilers, being supplied by the Vulcan Company, of Stettin. The designed speed was 35 knots with 36,000 shaft horse-power, but both have been considerably exceeded. This vessel, should the report be correct, is the swiftest destroyer afloat, exceeding the speed of the British destroyer "Swift."

Our Biggest Battleship.—The one battleship authorized by Congress will be considerably larger even than our latest ships. Her displacement will probably work out at between 30,000 and 31,000 tons. Dispatches from Washington state that the length of the ship over all will be considerably over 600 feet, the beam about 98 feet. She is to carry twelve 14-inch guns or two more than the "Oklahoma" and "Nevada." The armor of the "Pennsylvania," as she will be named, will probably be not less than 16 inches on the belt, turrets and barbettes. Her side armor will be placed in deep, horizontal strips, and the base of her single smokestack will be heavily armored.

Vast Subway Extensions for New York.—The amazing rate at which subway travel is increasing in this city has led to a more generous plan on the part of the Public Service Commission for future extensions of the road. The Commission states that the estimated cost of the new developments will be not under $350,000,000. They estimate that the total length of the single tracks in the whole system including the existing subway and elevated lines in Manhattan and the Bronx and the Rapid Transit lines of the Brooklyn Rapid Transit Company will be six hundred and twenty-nine miles, as against the length of two hundred and ninety-six miles of the existing line. In the year ending June 30th, 1911, about eight hundred million passengers were carried. When the new system has been built, the total capacity will be upward of three billion passengers a year.

Science

A New Comet.—We have received an announcement from Harvard College Observatory to the effect that Gale and Sydney discovered a comet on September 8th, 1912, in right ascension thirteen hours, thirty-seven minutes, one second and declination minus thirty-six degrees, thirty-one minutes and two tenths of a second.

Moving Pictures That Talk.—There was recently exhibited in Philadelphia the invention of Dr. Isadore Kitsee, an invention which is a very creditable attempt to produce talking moving pictures. Dr. Kitsee first attacked the problem in 1905. Just how Dr. Kitsee has succeeded in synchronizing a phonograph with a film we are not as yet able to reveal; but in a future number we hope to publish an article in which the invention will be discussed in more or less detail.

Polishing Metals.—All metals are very effectively cleaned for polishing by using a pasty solution of rottenstone and spirits of turpentine. This removes grease and is very effective against the oxide and sulphides which tarnish the metal and prevents effective polishing. After the application of the paste, it should be cleaned off by a dry cloth and the metal polished by any good means, polishing wheel, or a flannel cloth which is most effectively used.

Reducing the Brittleness of Glass.—The brittleness of glass is due to the quick cooling of the hot substance It is known that constant motion tends to rearrange the molecule in any substance and a similar effect is observed when glass is boiled in a week solution of salt in water, and allowed to cool gradually The toughness of the glass is increased very much, and the effect of quick heating is less disastrous to them. This is easily applied to articles used in the laboratory and to glass globes for lighting purposes, and prevents much breakage.

Women in German Universities.—The number of women students in the German universities is on the increase, and during the recent half-year there were 2,958 students on the list. These are distributed as follows: In the Prussian universities, 1,962, in the three Bavarian universities 279, in the two Baden universities, 417, and for the others in the German empire, 300; 2,500 of these students are of German nationality. 1,635 of them are following the courses of literature and history, 539 are engaged in natural sciences and mathematics, 625 in medicine, 74 in political economy or agriculture, 39 in law study, 28 in dentistry, 7 in pharmacy and 11 in theology.

The Influence of the Cinematograph.—A striking illustration of the influence of the ubiquitous cinematograph is reported by the American consulate at Belgrade American fashions have recently become very popular with the young men of that city; there is an unprecedented demand at the local shops for hats, boots, and other wearing apparel similar to that in vogue in the United States; and the American style of hair cutting has come into favor. These innovations are unmistakably the result of the exhibition of moving pictures of American origin. The obvious moral of all this, as the consul points out, is that the cinematograph might be used to great advantage in advertising all kinds of American products. For instance, pictures of American agricultural machinery in operation would probably create a great demand for the thing itself. This plan offers an economical substitute for the actual exhibition of American products in commercial museums and the like.

Synchronous Weather Maps for Eurasia.—The first step in making a scientific weather forecast is to draw a chart, based on telegraphic reports from meteorological stations, showing the distribution of pressure, temperature, clouds, winds, etc. The observations on which the chart is based should be as nearly simultaneous as possible; and, as forecasters have recently come to realize, it is also desirable that the chart should embrace as large an area as possible of the earth's surface The director of the meteorological service of Russia, General Rykachov, has just laid before his official colleagues of other countries a plan for the inauguration, beginning with the year 1915, of a system of strictly simultaneous telegraphic weather reports, twice a day, from stations scattered over the whole continent of Eurasia, and also from Iceland and the islands of Japan. At present simultaneous observations are available from all parts of Europe, but the stations of Siberia, India, China and Japan take their observations at different hours, and there is no general exchange of the Asiatic observations by telegraph. The "term-hours" proposed for the new system are 7 A. M. and 7 P. M., Greenwich time. The weather maps based on these observations would extend more than half way round the globe. It is proposed to publish the evening map in the European newspapers of the next morning, and the morning map in the afternoon papers. The great utility of such a plan is attested by the experience of the United States Weather Bureau, which now prepares a daily chart of telegraphic observations from a comparatively small number of stations extending around the world.

Aeronautics

Aeroplanes Cannot Land in Paris.—The French Prefect of Police of the Seine Department has issued an order forbidding aeroplanes to land within the limits of the city of Paris They are also forbidden to descend to, or ascend from, ground situated nearer than 500 meters (1,640 feet) from any inhabited building, excepting authorized aerodromes within the entire district of the Seine Department.

Aviation School for Australia. An aviation school will soon be opened in the Australian city of Duntroon under the auspices of the British War Office The Australian Minister for Defense ordered two biplanes and two monoplanes, and two aviators have already been chosen to pilot them Further machines are to be added from time to time, the idea being to maintain well-equipped branch stations of the flying corps at the State capitals and other important points

Paddle Wheel Propeller for Aeroplanes. Joseph Clarkson, of Manchester, Eng., last month made a series of highly successful experiments with a novel form of propeller. Instead of using a two- or three-bladed "fan" or "screw," he employs what corresponds to a steamer's paddle wheel. His tests were made on a light automobile for the purpose of measuring roughly the driving power, and it was found that an increase of 50 to 70 per cent was obtained over the same engine with "screw" propeller—according to the inventor

Military Aviation in England.—The question of army aeroplanes is making great progress in England just at present. Owing to the good results in the aeroplane flights made at the recent military competition, a bill is to be presented to Parliament for organizing a veritable aerial army, and in order to encourage officers to take part in this enterprise, special funds for pensions and insurances are to be set apart It is intended to increase the aeroplane material of the army to a great extent, and this will be seen from the fact that the budget for 1911–12 provided a credit of only $650,000, while the budget of 1912–13 will allot as much as $1,500,000, or more than double The Royal Aeronautic Corps will be composed of 8 fleets, and 7 of these include 12 aeroplanes each The remaining fleet consists of aeroplanes and airships. The officers will go through pilot training at the Salisbury Plain or Eastchurch grounds, but the second of these establishments is mainly used for marine aviators.

Howard Gill.—It is with deep regret that we record the death of Howard Gill at Chicago, on September 14th Gill's machine was run into by that of George Mestach Both machines were sent crashing to the ground forty feet below. Gill's machine turned over in the fall, burying the aviator beneath it It caught fire immediately after striking the ground Mestach was flying a Borel monoplane and Gill a biplane of the Burgess-Wright type. Mestach was a trifle behind Gill and apparently was endeavoring to pass above him, as Gill rounded the fourth pylon In the fast-gathering dusk it was difficult to see what really happened. It seems to be agreed that Gill's machine was overtaken and struck by Mestach's faster monoplane For an instant the two aeroplanes were locked together, then both plunged downward Gill died in a hospital. Mestach was also very badly hurt, so badly in fact that his recovery is despaired of at the time of going to press Readers of the Scientific American will recall that Gill was the one man who designed and built a machine to compete for the $15,000 prize offered by Mr Edwin Gould for a multi-motor flying machine To his lasting credit be it said that he was one of the few aviators in this country who took an interest in a prize which was offered solely for the purpose of making flying safer.

A New Altitude Record.—On September 17th Georges Legagneux established a new world's record for altitude for monoplanes at the Villacoublay aerodrome. He attained a height of 5,720 meters (18,761 60 feet); in other words, more than three and one half miles above the earth. The best previous record was that of Garros, who on Sept. 6th ascended in a Blériot to a height of 16,240 feet. Legagneux's feat was rendered possible, in a way, by the use of oxygen, which he was obliged to use after reaching an altitude of 15,748 feet The first one thousand meters were ascended in two and one half minutes; the next two stages of one thousand meters required five minutes each; the four thousand meter mark was reached in seven and one half minutes more, and the five thousand meter mark was attained in the next fifteen minutes The full height of five thousand seven hundred and twenty meters was attained in forty-five minutes, which is rather quick work as climbing goes. The descent from a height of more than three and one half miles was made in less than ten minutes. Above a height of 10,000 feet motors work with great difficulty and soon stop. In submarine boats, too, the motors stop long before the crew begin to feel any evil effects from the exclusion of oxygen Naturally the question arises: Why should it not be possible to combine with the internal aeronautic and submarine combustion engine an oxygen generating apparatus and to feed oxygen to the cylinders?

New Methods of Measuring Clouds

The Work of Besson at Montsouris Observatory

At many meteorological observatories the movement of clouds is measured by means of Fineman's nephoscope. This instrument consists of a magnetic compass, the case of which is covered with a black mirror, around which is movable a circular metal frame. A little window in this mirror enables the observer to see the tip of the compass needle underneath. On the surface of the mirror are engraved three concentric circles and four diameters, one of the latter passes through the middle of the little window. The mirror constitutes a compass card, its radii corresponding to the cardinal points. On the movable frame surrounding the mirror is fixed a vertical pointer graduated in millimeters, which can be moved up and down by means of a rack and pinion. The whole apparatus is mounted on a tripod stand provided with leveling-screws. To make an observation, the mirror is adjusted to the horizontal with the leveling-screws, and is oriented to the meridian by moving the whole apparatus until the compass needle is seen, through the window, to lie in the north-south line of the mirror (making, however, allowance for the magnetic declination). The observer stands in such a position as to bring the image of any chosen part of a cloud at the center of the mirror, and the vertical pointer is also adjusted by screwing it up or down and by rotating it around the mirror until its tip is reflected in the center of the mirror. As the image of the cloud moves toward the circumference of the mirror the observer moves his head so as to keep the tip of the pointer and the cloud image in coincidence. The radius along which the image moves gives the direction of the cloud's movement, and the time required to pass from one circle to the next its relative speed, which may be reduced to certain arbitrary units.

This instrument is, however, not very easy to use, and gives only moderately accurate measurements.[1] Accordingly M. Louis Besson, the able director of the Observatory of Montsouris, invented his "comb nephoscope" (Fig 1) in order to secure more accurate determinations of the direction and velocity of cloud movements. This apparatus consists of a horizontal bar fitted with several equidistant spikes and mounted on the upper end of a vertical pole which can be rotated on its axis. When an observation is to be made the observer places himself in such a position that the central spike is projected on any chosen part of a cloud. Then, without altering his position, he causes the "comb" to turn by means of two cords in such a manner that the cloud is seen to follow along the line of spikes. A graduated circle, turning with the vertical pole, gives the direction of the cloud's motion; it is read with the aid of a fixed pointer. Moreover, when the apparatus is once oriented, the observer can determine the relative speed of the cloud by noting the time the latter requires to pass from one spike to the next. If the instrument stands on level ground, so that the observer's eye is always at the same height, and if the interval between two successive spikes is equal to one tenth of their altitude above the eye-level of the observer, one need only multiply by 10 the time required for the cloud to pass over one interval to determine the time the cloud travels a horizontal distance equal to its altitude.

M. Besson has also revived an old method of Bravais for measuring the actual height of clouds. The apparatus in this case consists of a plate of glass having parallel faces, mounted on a graduated vertical circle which indicates its angle of inclination. A sheet of water (Fig 3), situated at a lower level, serves as a mirror to reflect the cloud. The water is contained in a reservoir of blackened cement surrounded by shrubbery, and is only a small fraction of an inch in depth, so that the wind may not disturb its level surface.

The observer, having mounted the glass plate on the horizontal axis of a theodolite (Fig 2) set on a window sill some 30 or 40 feet above the ground, places his eye close to it and adjusts its inclination so that the images of a cloud reflected in the plate and in the sheet of water coincide. Then from a curve traced once for all on a sheet of plotting paper he reads off the altitude of the cloud corresponding to the observed angle of the glass plate. The curve is plotted from simple trigonometrical calculations.

At the Observatory of Montsouris the degree of cloudiness, i. e., the amount of the whole sky covered with clouds at a given moment, is determined by means of the *nephometer* (front page), also devised by M. Besson. This consists of a convex glass mirror, a segment of a sphere, about twelve inches in diameter, in which

Fig. 1.—Besson's comb nephoscope.

By means of two cords attached to the vertical axis the observer turns the "comb" until the cloud appears to travel along it. A dial at the base of the axis indicates the direction of the cloud's motion.

is seen the reflection of the celestial vault divided into ten sections of equal area by means of lines engraved on the glass. As shown in our front page engraving, the meteorologist observes through an eyepiece fixed in an invariable position with respect to the mirror, which latter turns freely on a vertical axis. The observer, whose own image partly obstructs sections 8, 9, and 10, notes the degree of cloudiness in the sections numbered 1 to 7. The cloudiness of each section is estimated on a scale of 0 to 10; zero meaning cloudless, and 10 entirely overcast. He now rotates the mirror and eyepiece 180 degrees and observes the cloudiness in sections 7, 5, and 2, which represent the regions of the sky that at the first observation corresponded to sections 8, 9, and 10.

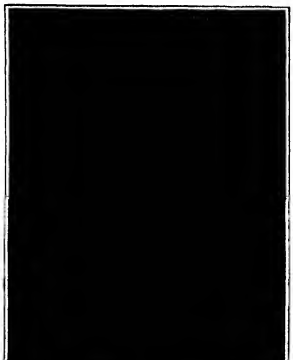


Fig. 2.—Glass plate and vertical circle.

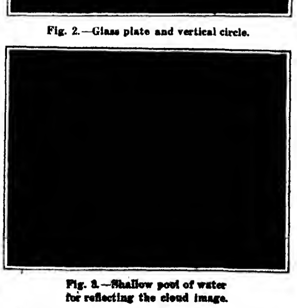


Fig. 3.—Shallow pool of water for reflecting the cloud image.

MEASURING THE HEIGHT OF A CLOUD

[1] A greatly improved form of reflecting nephoscope, based in part upon Fineman's, was introduced in 1896 by Prof. C F Marvin for the use of the U. S Weather Bureau.

Why Not Feet Per Second?

It is a singular testimonial to the persistence of impressions and the natural conservatism of mankind that we continue to use familiar expressions long after they have lost their original correctness of application. Thus we say "miles per hour" in estimating rates of speed, even in cases where only very short distances are covered. This practice has become a habit, and not a very creditable one at that. Much better would be the expression "feet per second," and this phrase would be equally understandable and far more explicit. "Miles per hour" is easily reduced to "feet per second" by a simple formula (the multiplying of the rate of speed in miles per hour by 1.467). Conversely, the rate of speed in feet per second is converted to miles per hour by multiplying the "feet per second" figures by 0.682. Approximately, "feet per second" is one and a half times "miles per hour," and similarly "miles per hour" is about two thirds "feet per second." The following table will be found useful for quick comparisons:

Miles per Hour.	Feet per Second.	Feet per Second.	Miles per Hour.
1	1 47	1	.68
2	2.93	2	1.36
3	4.40	3	2.04
4	5.87	4	2.73
5	7 33	5	3 41
6	8 80	6	4 09
7	10 27	7	4 77
8	11 73	8	5 45
9	13 20	9	6 14
10	14 67	10	6.82
20	29 33	20	13 64
30	44 00	30	20.45
40	58 67	40	27 27
50	73 33	50	34 09
60	88 00	60	40 91
70	102 67	70	47 73
80	117.33	80	54 54
90	132 00	90	61.36
100	146 67	100	68.18

Eskimo Dogs for the Market

At Grove Park, one of the suburbs of London, Mrs. Scott conducts a very interesting dog farm. Her specialty is Eskimo dogs, which she breeds and trains for the market. The market is not very large, but it is sufficient to make it worth her while to raise and train the best possible Eskimo dogs. It is not the food market, nor the ordinary dog market. It is the market for Eskimo dogs which are trained for Arctic exploration. If you decide to make a journey to one of the poles, you know that Eskimo dogs are absolutely essential. You can get good Eskimo dogs in Greenland, or in Alaska. But the good dogs in Greenland may not be exported except by special permission of the Danish government; and the good dogs in Alaska are not so good. One trouble with ordinary Eskimo dogs is that they have no breeding and no discipline. They will obey the master with whom they have been brought up, but when they start after fish or other game, even their master can control them only by the exercise of brute force. For the purposes of your exploration you need dogs that will obey orders given by a white man, dogs that are broken to the harness and are not afraid of work, dogs that have learned team work.

It is this kind of dog that Mrs. Scott raises for the market. Her kennels have only pure blooded animals of carefully selected stock, and from earliest puppyhood she trains them in how to eat and how to work. When she gets through with an Eskimo dog the animal is not nearly so ferocious as one that just "growed up" in the surroundings of an Eskimo village. They adapt themselves quickly to new masters, and they have acquired good eating manners, so that they are not so likely to attack the cupboard or fresh game. Mrs. Scott feeds her animals no meat except pemmican, and dried fish brought from Norway; a large part of the diet is a specially prepared biscuit. She has supplied trained dogs for a number of Arctic and Antarctic expeditions.

How to Make an Ultra-violet Ray Objective

By G. Michaud and J. F. Tristan, Costa Rica College

BECAUSE ultra-violet rays are black light to our eyes we are in ignorance of many of their properties; yet there is an artificial eye, which—as Prof. Wood has shown—can tell us much about their behavior. Amateur photographers with a scientific turn of mind (owners of a camera, who read the SCIENTIFIC AMERICAN belong *de ispe facto* to that class) may contribute to the progress of science, and will find considerable pleasure in the practice of photography with ultra-violet rays. There is no need of expensive apparatus; the only necessary addition to the camera is an objective transparent for ultra-violet rays and only for them; that is, a silvered quartz lens. This is easily made by the amateur himself, with a common spectacle pebble lens. For many reasons it is desirable that this quartz lens be of the same focus as the ordinary objective regularly used on the camera. Moreover, it should be of the periscopic type which, with the diaphragm placed as shown in Fig. 2, will give a satisfactory definition evenly distributed all over the field. All manufacturing opticians sell spectacle pebble periscopic lenses of any desired focus. (Price: $0.50 per lens.) The covering of such a lens with a thin silver film requires the preparation of Liebig's bath· Two grammes of pure fused silver nitrate are dissolved into 40 cubic centimeters of water. Ammonia is added, little by little, until the precipitate formed by the first additions has disappeared. Then 90 cubic centimeters of a 3 per cent solution of caustic soda is slowly poured into the liquid. A black precipitate appears. It is dissolved by means of a few drops of ammonia. Water is then added until the total volume of the solution is 290 cubic centimeters. Last, a weak solution of silver nitrate is added, drop by drop, until one last drop causes a permanent precipitate.

The lens, which has been cleansed, first with soap and water, then with alcohol, is laid horizontally in a glass vessel with its two extreme ends resting on two glass stoppers, the inferior face being about two inches from the bottom of the vessel. Nine volumes of the silver solution are rapidly mixed with one volume of a 10 per cent solution of milk sugar. The mixture is poured into the vessel until it bathes the interior face of the lens. The whole is then left for about four hours in a dark place. Then the lens is immersed ten minutes in rain water and left to dry.

The same operation should be repeated for the other face. The writers found the silvering of the lens on both sides to give more complete and reliable results than a single silver film. It seems difficult to get a film totally free from capillary holes. These do not correspond on two films and the experimenter feels sure that if some visible light has been admitted it had no share in the formation of the image.

With the help of a few strips of black paper the lens is glued, with its convex face upward, over a black pasteboard tube which can be telescoped, at any time, into the objective tube of the camera, behind the shutter, in lieu of the regular objective. Fig. 1 is a section of the ultra-violet ray objective thus made, and Fig. 2 shows it in place, mounted on a Unicum shutter, in lieu of the regular rectilinear combination, the two lenses of which have been unscrewed and put aside.

With a lens made as stated, exposure for a landscape in full sun at noon in June and with an aperture of F/16 should last at least twenty minutes. Photographs of pigments, chemicals, spectra, landscapes, skies, microscopic objects and portraits should always be made twice, once with the ultra-violet rays objective and once with the regular objective. Any peculiarity of the invisible light reflected by the object is thus easily detected. While working on these lines the writers found that while chalk, lime phosphate, arsenious oxide, starch, caffein, and veratrin reflected ultra-violet light about as well as ordinary light, papaverin, quinine sulphate, bismuth subnitrate, practically did not reflect ultra-violet rays. If our retina were sensitive for these rays only, such substances would appear to us as black, in spite of their white color in ordinary light. On the other hand, mercury biiodide, mercuric oxide and orpiment reflected ultra-violet light relatively better than actinic light. Figs. 3 and 4 show a curious result of such differences. Upon a copy of the SCIENTIFIC AMERICAN a layer of mercuric iodide was deposited in the middle of a concentric layer of papaverin. On the photograph made with the ordinary objective the extremely white papaverin looks, of course, whiter than the paper and the red mercuric compound darker than both. The reverse relation can be observed on the photograph made with the silvered quartz lens.

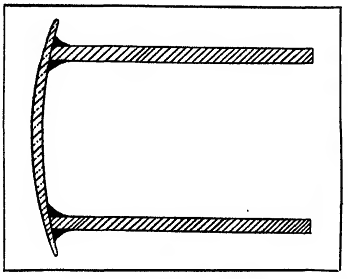


Fig. 1.—Longitudinal section of the ultra-violet ray objective.

Fig. 2.—The ultra-violet ray objective in temporary position.

Fig. 3.—Photograph of mercuric iodide, white papaverin and white paper.

Fig. 4.—Ultra-violet ray photograph of materials shown in Fig. 3.

HOW TO MAKE AN ULTRA-VIOLET RAY OBJECTIVE

The World's Production of Gold

By Edward B. Howell

THE accompanying chart shows graphically the world's production of gold from the discovery of America to the close of the year 1911. The horizontal divisions of the chart measure the lapse of time by ten-year periods. The vertical divisions represent the value of the production in American money, each division representing ten million dollars. The production of silver until its demonetization in 1873 is also shown superimposed on the gold production. Anterior to the discovery of America, the existing stock of gold and silver money in the world is estimated by William Jacob, an English economist who made a very careful investigation of the subject nearly a century ago, to have been from 33,000,000 to 34,000,000 pounds sterling. In round numbers this was $170,000,000 of our money. This amount, relative to the subsequent production, is indicated on the chart by the small square in the circle.

In 1911, the world's production of gold was $466,000,000. Comparing this with the world's stock of money when Columbus discovered America, it may be said that the gold miners of the world last year produced two and three fourths times as much gold as was represented by the world's total accumulations of gold and silver money in 1492. To make the comparison in another way, in 1911 it took the gold miners of the world less than five months to produce an amount of gold equivalent to the world's entire stock of gold and silver money when Columbus discovered America.

It will be seen from this chart that the production of gold in any considerable quantities is a modern function. The sudden increase in gold production began within the memory of many men now living. It began near the middle of the last century when placer gold was discovered in California and Australia.

When the supplies from these newly discovered placer mines began to fail, there followed a period of waning production. During this period silver was demonetized in the leading commercial countries of the world, and this demonetization, coincident with a waning gold supply, and occurring during an era of rapidly expanding trade, occasioned a sharp advance in the purchasing power of gold. In 1873, it required $1.15 per bushel on an average to purchase the wheat crop of that year from the farmers of the United States, but in 1893 the same crop was bought for an average

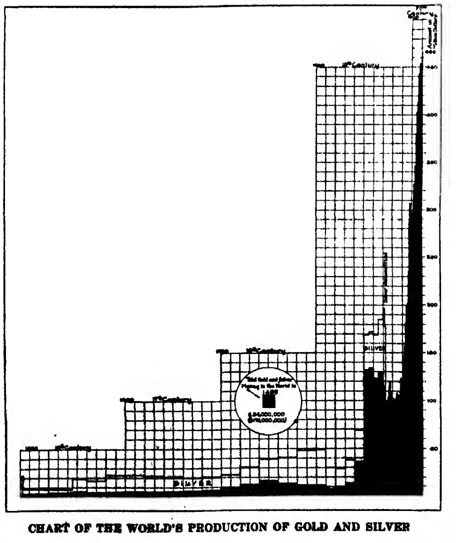


CHART OF THE WORLD'S PRODUCTION OF GOLD AND SILVER

price of 53 2/5 cents From the chart it will be seen that about twenty years ago the production of gold ceased to decline and there began a phenomenal increase It was this enormous increase in the production of gold that effectually settled the so-called "silver question"

During the memorable presidential campaign of 1896, the people of the United States by their votes decided against the remonetization of silver, believing that such a measure would result in a cheapening of our money and a consequent loss in its purchasing power In 1896 the world's combined production of gold and silver (estimating the silver at its former coining value) was $405,320,800 But in 1911 the world's production of gold alone exceeded this amount by over $60,000,000

The twentieth century is not very old as yet, but during its eleven years of gold production there has been produced in the world a greater amount of gold by over $1,000,000,000 than was produced during the 356 years from the discovery of America to the discovery of gold in California. During the twentieth century gold is being produced over forty times as fast as it was during the period between 1492 and 1849.

From the discovery of America to the close of the year 1911 the production of gold in the world was something over $14,000,000,000. This was about $10 per capita for all the inhabitants of the globe. But of this vast amount of gold over forty per cent has been produced within the last score of years. This flood of new gold has come principally from its ores as distinguished from placer deposits. Improved modes of concentration and amalgamation, and above all the cyanide process, making profitable the reduction of ores that formerly could not be treated, have brought about the increase. Where this rapidly mounting column of gold production will terminate does not yet appear. If commodity prices continue to advance, it is very certain that some gold mines will be compelled to shut down, for food, clothing and other supplies are necessarily consumed in the process of producing gold, and when gold has so declined in purchasing power that it will no longer buy the things necessary to its production, then at the point or points where this event has occurred, its production will necessarily cease.

Finally, no thinking man can avoid the conclusion that this modern increase in gold production has been a cause, probably the chief cause, of the modern rise of commodity prices. If this is true, then, instead of blaming the trusts for high prices, we should be blaming the too active gold miners of the world.

The Nature and Origin of Life

Prof. Schaefer's Inaugural Address of the British Association

IN opening the discussion of any topic, a natural procedure to follow is to start by defining one's fundamental concepts and terms Thus the first paragraph of Prof. Schaefer's inaugural address before the British Association at Dundee is devoted to the problem of "defining" life. But the conclusion reached may appear to some unsatisfactory Prof. Schaefer wisely refrains from giving any definition. "I have the less inclination to do so (i e., to furnish a definition) because recent advances in knowledge have suggested that the dividing line between animate and inanimate matter is less sharp than it has hitherto been regarded."

In the popular mind there is a tendency to associate together, as if they were inextricably linked together, life and intelligent consciousness. This finds expression in such terms as "animate" and "inanimate," which are commonly used practically as synonyms for "living" and "lifeless," respectively. But there is no scientific warrant for this point of view, and the problems considered by Prof. Schaefer are essentially problems of matter, not problems relating to the "soul" (anima)

Having given up as practically hopeless the attempt to define life, we may next approach the seemingly easier task of describing life in terms of its most characteristic manifestations. But here also we are confronted with difficulties. The man in the street, if he thinks about such things at all, will, in answer to our inquiry after the most characteristic property of living beings, probably mention their power of spontaneous movement But quite apart from the fact that a large class of living forms—the higher plants—possess this power at most in very rudimentary form, recent developments of science have disclosed purely physical systems—liquid crystals and similar bodies—which manifest seemingly spontaneous motions resembling with astounding closeness those of living forms

Another property which is commonly cited as specially characteristic of living matter is its power of growth by assimilation from the surrounding medium of matter similar to its own substance. But in this respect also crystals resemble living organism, and the analogy even extends to the formation of new individuals when the "parent" has reached a certain size.

Turning from the physical phenomena of life to the chemical aspect of life processes, a similar observation must be made: the early workers in the field of organic chemistry supposed that the compounds met with in the living organism were peculiar, could be produced only under the influence of a specific "vital force," and were beyond the reach of the creative powers of the chemical laboratory. This illusion was shattered in 1828 by Wöhler's synthesis of urea, followed by innumerable further results all pointing in the same direction, and culminating in the recent work of Fischer and others who are building up polypeptides substances of the nature of the albuminoids and proteids of the living organisms. There seems to be no vestige of evidence that, in order to explain the chemistry of the living body, we must invoke the aid of a specific "vital force"—we have in fact here, apparently, another case of a mere name without objective counterpart.

Having reached this point of view, the question naturally presents itself to our minds, whether living matter itself may not some day be produced in the chemical laboratory -whether the chemist is destined some day to "create" a living thing. Indications are wholly favorable, in Prof. Schaefer's opinion, to the ultimate realization of this, if only we are reasonable in our expectations. It is not a complicated organism which we must look for (even the lowest forms of life known to us *in nature* are highly complex structures), but something exceedingly elementary, to which indeed we may at first hesitate to attribute "life" as ordinarily understood. It must be remembered that the earliest forms of life on our earth were probably quite incapable of leaving any geological record behind them, as they no doubt consisted entirely of soft parts.

There is much in Prof. Schaefer's address which we would like to dwell on at length, but lack of space forces us to pass over with a mere mention those sections of his paper which deal with the more generally known phases of the theory of evolution. His remarks on the cell-aggregate of the higher organism on cell-life and aggregate life, however, call for more leisurely consideration.

"Our own life, like that of all the higher animals, is an *aggregate life*, the life of the whole is the life of the individual cells. The life of some of these cells can be put an end to, the rest may continue to live.

"On the other hand, if a few cells, such as those nerve-cells under the influence of which respiration is carried on, are destroyed or injured, within a minute or two the whole living machine comes to a standstill, so that to the bystander the patient is dead; even the doctor will pronounce life to be extinct. But this pronouncement is correct only in a special sense What has happened is that, owing to the cessation of respiration, the supply of oxygen to the tissues is cut off. And since the manifestations of life cease without this supply, the animal or patient appears to be dead If, however, within a short period we supply the needed oxygen to the tissues requiring it, all the manifestations of life reappear.

"It is thus only some cells which lose their vitality at the moment of so-called 'general death.' Many cells of the body retain their individual life under suitable circumstances long after the rest of the body is dead. Sherrington observed the white corpuscles of the blood to be active when kept in a suitable nutrient fluid weeks after removal from the blood-vessels. A French histologist, Jolly, has found that the white corpuscles of the frog, if kept in a cool place and under suitable conditions, show at the end of a year all the ordinary manifestations of life. Carrel has succeeded in substituting entire organs obtained after death from one animal for those of another of the same species, and has thereby opened up a field of surgical treatment, the limit of which can not yet be discerned "

It is thus evident that in the higher animals the "aggregate life" is closely dependent on a proper adjustment and coördination between the "cell life" of the separate organs. Such coordination is secured by a two-fold mechanism: On the one hand by nervous control, and on the other by the diffusion through the system of so-called *hormones*. Nervous control of body-functions may be purely reflex and unconscious, or at least, outside the scope of our will, as is the case, for instance, with heart action in normal individuals. Or it may be more or less directly governed by our will and emotions.

The influence of hormones upon bodily functions is of a somewhat different character. Hormones are internal secretions produced in various glands and poured through various channels into the general circulation. Their action is presumably of the nature of a chemical stimulus. Nervous impulses are apparently carried by propagation along nerve strands somewhat as electricity travels along a wire (though the velocity of a nerve impulse is very much smaller). Hormones, on the other hand, depend for their action on actual convection from their place of manufacture, the internal gland, to the points at which they produce their effect. Among the glands which secrete hormones are various structures whose significance remained a mystery until the function of their substances was understood. Such glands are the suprarenal capsules, secreting adrenalin (the only hormone which has so far been reproduced by synthesis in the laboratory), the pituitary body, abnormal development of which is accompanied by abnormal bodily growth (gigantism), and several others which we can not stop to mention.

Allied in character to the action of hormones is that of antitoxines, protective substances produced by the body in reaction to an invasion by disease germs.

At such times the battle for our life is fought with chemical weapons. The bacteria produce toxins, substances which poison us, while our body produces antitoxins, unconsciously putting out poison for this microscopic vermin, much as consciously we put out poison for larger representatives of the parasite tribe.

The discussion of life and disease naturally leads us at last to the consideration of death. This takes place either through accident, disease, or old age. The first two causes are more or less preventable, perhaps, when science has advanced sufficiently far, wholly so. The last is probably a cause inherent in the nature of life, and unavoidable. But, as Prof. Schaefer points out, a natural death by old age, not hastened nor agonized by disease, should be a quiet, painless phenomenon, unattended by violent change. And if we were all certain of a quiet passing; were we sure that there would be "no moaning at the bar when we go out to sea," we could anticipate the coming of death after a ripe old age without apprehension.

A Natural African Silk

IT is proposed to make a commercial use of a native silk coming from the African region which does not appear to have been utilized heretofore. This is a silk found in the Belgian Congo region, and it is furnished by worms of the anaphe, which variety is widespread in the Uganda, the German east Africa, Cameroon and Congo as well as other regions. The African silk corporation has already begun to install plants of the kind in the Uganda and elsewhere, and two other firms are soon to begin work in Belgian Congo. The worms are very voracious and are covered with hairs which have a stinging effect on the skin. They hardly ever change their place except during the night in order to seek food or search for good places for building their nests. They feed on plants such as *Abizza fastigiata*, also *Bridelia micarantha* and others. On the under side of this latter leaf, the anaphe lays 200 or 300 eggs placed in piles and covered with a protecting down. About two months after hatching, the worms proceed to make a combined effort in order to build a kind of nest upon the plants which furnish their food. The nest is of a silky appearance and has a color varying from coffee color to a rusty red. Of an irregular shape, the nests have a size ranging from that of an egg up to a child's head, and they contain from 10 to 100 cocoons tightly pressed together. When the butterfly is hatched, it secretes a liquid which attacks the cocoon and the envelopes of the nest, so that it can find its way to the outside. It appears that this does not injure the silk of the cocoons, so that it is not required to smother the insect within the chrysalis to avoid hatching the butterfly. The nests must be handled under water in order to prevent the nettle-like action of the hairs upon the skin, such hairs and also fragments of skin being scattered through the nest. The silk of the envelopes and that of the cocoons are treated separately, the operation being a washing with carbonate of potash solution until no more color is discharged, then the silk is dried in the air and packages of it are sent to the factories. The yield in the present case is estimated at 1 pound of silk thread coming from 6 pounds of raw silk. It does not seem difficult to carry on silk raising in this case, as the matter of acclimating the silk worm, which is such an important one with the usual kind, does not need to be dealt with here, either for the insect nor for the food plants. No diseases attack the insects, as far as can be noticed.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Mississippi River

To the Editor of the SCIENTIFIC AMERICAN:

Noting your editorial of May 25th, page 475, we would like to present the following solution of the Mississippi problem.

Construct a ship canal as follows:

Leave the east bank of the Mississippi River at some point between Memphis and Cairo.

Parallel the river southward until the highlands east of Memphis are passed.

Then follow the general direction of the contour lines toward the southeast.

Continue through the level plains of Mississippi and southern Alabama into Georgia, dropping gradually through the contour lines toward the Gulf of Mexico.

When a point north of the Florida peninsula is reached, turn slightly to the southward and cross all the peninsular contour lines near their centers or highest points.

Dredge the Alabama River and other streams of importance crossed by this proposed route of ship canal.

Place locks and spillways, at the points where important streams cross the ship canal, so as to regulate water levels and facilitate commerce.

ADVANTAGES TO BE GAINED.

1. Relief to the congested lower Mississippi River at flood time.
2. Regulation of the Mississippi River flow at all high-water periods.
3. The creation of an inland system of waterways which will become equal in importance to the Mississippi River.
4. A limited supply of water for irrigation where needed along the upper portion of the canal.
5. An unlimited supply of flood water for irrigation throughout the entire Florida peninsula in the season of greatest need.
6. Silt and clay sediments to balance the sandy soil of Florida in the fields and on the country roads.
7. Fertilizer where it is most needed.

J. L. GOULD.
Fort Myers, Fla. GEORGE M. LUMMIS

America and the Gordon Bennett Cup

To the Editor of the SCIENTIFIC AMERICAN:

The question asked in your editorial of September 14th, as to the reasons for the exceedingly poor showing made by America in the Gordon Bennett Cup race suggests several collateral questions.

1. Is not the greatest difference between American machines and French ones almost entirely a difference in the degree of perfection of details of the machine?

2. Is not this difference almost entirely due to the characteristic of the French engineers and machinery manufacturers of taking infinite pains, even with the most minute details?

3. Is this due to a difference in temperament, or to the difference in the keenness of competition to which engineers and manufacturers are in general subject in the two countries, or to the difference in thoroughness of the superintendents actually in charge of the workshops, or to the fact that the lower cost of skilled labor in France makes it possible to give to the actual work of construction an amount of time that would be prohibitory in this country?

4. Has not our record in aviation thus far been closely parallel to our record in the development of the automobile, where we did much more notable work in the field of invention than in the workshop? We are distancing the world in the third stage of automobile development—that of supplying the world's demand for efficient low-priced machines, and no doubt we shall repeat this performance when this stage of development is reached in aviation.

5. Is not the progress which our inventors and builders have made in hydro-aeroplanes fully as important as the more spectacular achievement of speed?

6. Is not the great need of aviation in America at this time, if we are to prove worthy competitors of the French in speed events, that we by some means attract to it many more engineers who are also skilled shop men and who have not only a high degree of ability, but also the characteristic of taking infinite pains with even the minutest details?

7. Can the money which this requires be secured in any other way than that through which the French builders secured it; namely, through the awakening of the national government to the importance of aviation in connection with national defense, to the point where the government provided the funds for the purchase at liberal prices of the product of the builders, and the liberal patronage of that part of the public who were both ready and able to co-operate financially?

As the pressure of other matters prevents me from being actively engaged in aviation work at the present time, I have written the above from the point of view of "one on the fence" in the hope that it may, as is sometimes the case, suggest some point of value to the real workers who are usually too busily engaged on problems of immediate importance to make general surveys of the field.

New York city. CHARLES M MANLEY.

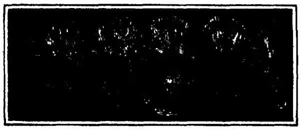
Laces and Flour from Bananas

To the Editor of the SCIENTIFIC AMERICAN

I am an old subscriber of the SCIENTIFIC AMERICAN, which I consider as the queen of all the reviews of this kind.

In the issue of February 17th, 1912, page 151, under the heading "Banana Cloths," is said: "It has been left to the Chinese to teach us how the tons of banana fiber thrown on the rubbish heap every year can be converted into banana cloth and sold at a most remunerative price." I take the liberty of giving to you the knowledge that long before the Chinese the Brazilians had utilized the fiber of banana trees for cloth and ladies' garments. I inclose a sample of lace that is sold here for one milreis a meter, which corresponds to about 12 cents a foot in American gold.

Also in your issue of July 13th, 1912, page 23, banana flour is advertised as a novelty in the French industry. I send to you one small can of this product, made here by us, which like the banana cloth, has been on our markets in Brazil over twenty years.



Lace made from fibers of banana.

Though you will not be responsible for statements made in the correspondence columns of your journal, I think I must call your attention to the facts above mentioned in favor of our national industry here.

Para, Brazil FRANCISCO BOLONHA, C E.

The Steel Rail Problem

To the Editor of the SCIENTIFIC AMERICAN:

I have read your editorial in the issue of August 24th with a great deal of interest, and some surprise. I have been a reader of the SCIENTIFIC AMERICAN for a great many years, and have always found its editorials fair in every way, but in this case I think you are not treating the steel makers fairly when you place all the blame for defective and unsafe rails upon them, when the fact is that the railroads themselves are the ones to blame because they insist in their specifications upon such hard steel, steel which will pipe, and which the most careful examination will not detect. A discard or cutting off of 50 per cent of the ingot or bloom would not be sure to discover all of the piping. It is impossible to detect the last tracing of piping by cutting the bloom when it is hot. It could only be done by nicking and breaking cold. This, of course, is impossible in the regular manufacture of rails.

I am not a rail maker or connected with any works making rails, but for over forty years I have been connected in different capacities with the manufacture of open hearth and Bessemer steel in this country, and, therefore, feel that I ought to know something about it.

Ever since the manufacture of melted steel was begun by Huntsman in Sheffield, more than one hundred years ago, one of the greatest expenses of the process of making high carbon steel has been caused by the piping and the waste occasioned by the steel makers being obliged to top the ingots, that is break them cold until every trace of the pipe is removed. In many cases over one half of the ingot is removed before this has all disappeared. This seems to be as much of a problem with the tool steel maker to-day as it was forty years ago, and this trouble is had with ingots of very small section; most of them 4 to 6 inches square. The piping increases with the size of the ingot, which in most rail mills to-day are from 18 inches to 22 inches square.

You say the steel makers are to manufacture the kind of steel that suits their particular whim. It is many years since they have been allowed to do this. Detailed specifications as to every detail of the manufacture are made, and the inspectors watch day and night to see that the specifications are carried out to the letter, in many cases almost taking the manufacture out of the steel makers' hands.

You say in your article that it is well understood by engineers that it is possible to produce a rail that will stand up under very high speed traffic, and that the failure to produce them is entirely due to the rail makers themselves.

I would like to see proof that this is well understood by engineers. You will, I think, find that the general opinion of engineers is that the rails are made strictly to the railroad's own specifications, and that, therefore, the fault lies with them.

Now the question is, what is the remedy for all this trouble? The answer is very simple, make steel that is low in carbon and phosphorus that will pipe very little if at all. This can be done, but if this is proposed the railroad men immediately say that they will have a rail that will not wear well, they will wear out in a very short time, so they insist on having a hard and consequently brittle rail, and take the risk of broken rails, costly wrecks and the killing of passengers.

Much is being learned lately about alloyed steels, and we now know that there are other hardeners that can be used besides carbon that do not cause piping, but these will increase the cost of the steel somewhat, which the railroad companies would probably object to. First cost seems to be all that the average purchasing agent thinks of.

So it boils down to this—the railroad company in order to save money in renewals insist that the steel maker give them rails that they (the steel makers) know are brittle and unsafe to use, saying in effect "That's none of your business, we will take the risk," and they do, and they and the travelling public pay the bills.

You do not seem to think that the present schedules of the fastest railroad trains are too fast for safety. In this you do not agree with many of the best railroad men in this country. I feel sure they have more than reached the safe limit, and many a railroad man will breathe easier and thank God when such trains as the 18-hour fliers between New York and Chicago are cut down in speed, as they ought to be at once. I speak with a great deal of feeling on this subject because the craze for high speed in railroading has cost me the lives of a dearly beloved brother and two others of the leading men of a large manufacturing concern with which I am connected.

Cleveland, O. S. T. WELLMAN

Gyroscopic Action of Revolving Aeroplane Motors

To the Editor of the SCIENTIFIC AMERICAN:

Less than two hours before the accident that killed Paul Peck I had a talk with him on the subject of the danger in gyroscopic force. He admitted that at times this force had caused him considerable trouble, but said that he did not believe it to be particularly dangerous. I explained to him several conditions that would excite gyroscopic force in his motor to a point where it would become highly dangerous, and told him that should he ever meet one of these conditions he would be at once convinced that I had not over-estimated the peril, but that he would then be in the same fix as the other fellows that have gone before—*not able to tell about it!* The newspaper accounts of the accident say "No one but Paul Peck could tell exactly what caused the accident."

I had just examined Peck's new machine and told him that he would have to be extremely cautious in the use of his controls as it, in my opinion, would be highly susceptible to the elevator and would rock lightly about its lateral axis. You will notice by the newspaper accounts that after his first flight he spoke particularly about this very feature, and it was no doubt one of these sudden dips that excited gyroscopic force and caused the spiral movement in his machine. I found three eye witnesses, not one of whom was an aviator, who distinctly saw Peck turn his controls contrary to his path of flight, but in all the accounts of the accident, given out by the aviators, not one of them mentioned the fact that the machine spiraled with its *rudder turned to the outside of the circle* and *pitched downward with its elevator raised to the limit!* Nor did any one think it worth while to mention that during all this time the motor was spinning at top speed; yet these three features of the accident, completely ignored in all published accounts, show the real cause and prove the brutal strength of this force when once it is set in motion.

Peck said that while he did not believe there could be any great danger from gyroscopic force, he was open to conviction and asked me to bring out to him on the following afternoon a copy of my new article on the subject. I was there with the copy at the appointed hour, but too late to save the poor fellow.

How much longer are they going to fight against the truth? How many more lives must be sacrificed before they will understand?

Chicago, Ill. THOMAS PRESTON BROOKE

price of 53 2/5 cents. From the chart it will be seen that about twenty years ago the production of gold ceased to decline and there began a phenomenal increase. It was this enormous increase in the production of gold that effectually settled the so-called "silver question"

During the memorable presidential campaign of 1896, the people of the United States by their votes decided against the remonetization of silver, believing that such a measure would result in a cheapening of our money and a consequent loss in its purchasing power In 1896 the world's combined production of gold and silver (estimating the silver at its former coining value) was $405,320,800 But in 1911 the world's production of gold alone exceeded this amount by over $60,000,000

The twentieth century is not very old as yet, but during its eleven years of gold production there has been produced in the world a greater amount of gold by over $1,000,000,000 than was produced during the 356 years from the discovery of America to the discovery of gold in California. During the twentieth century gold is being produced over forty times as fast as it was during the period between 1492 and 1849.

From the discovery of America to the close of the year 1911 the production of gold in the world was something over $14,000,000,000. This was about $10 per capita for all the inhabitants of the globe. But of this vast amount of gold over forty per cent has been produced within the last score of years. This flood of new gold has come principally from its ores as distinguished from placer deposits. Improved modes of concentration and amalgamation, and above all the cyanide process, making profitable the reduction of ores that formerly could not be treated, have brought about the increase. Where this rapidly mounting column of gold production will terminate does not yet appear. If commodity prices continue to advance, it is very certain that some gold mines will be compelled to shut down, for food, clothing and other supplies are necessarily consumed in the process of producing gold, and when gold has so declined in purchasing power that it will no longer buy the things necessary to its production, then at the point or points where this event has occurred, its production will necessarily cease.

Finally, no thinking man can avoid the conclusion that this modern increase in gold production has been a cause, probably the chief cause, of the modern rise of commodity prices. If this is true, then, instead of blaming the trusts for high prices, we should be blaming the too active gold miners of the world.

The Nature and Origin of Life

Prof. Schaefer's Inaugural Address of the British Association

IN opening the discussion of any topic, a natural procedure to follow is to start by defining one's fundamental concepts and terms. Thus the first paragraph of Prof. Schaefer's inaugural address before the British Association at Dundee is devoted to the problem of "defining" life. But the conclusion reached may appear to some unsatisfactory Prof. Schaefer wisely refrains from giving any definition "I have the less inclination to do so (i. e, to furnish a definition) because recent advances in knowledge have suggested that the dividing line between animate and inanimate matter is less sharp than it has hitherto been regarded."

In the popular mind there is a tendency to associate together, as if they were inextricably linked together, life and intelligent consciousness This finds expression in such terms as "animate" and "inanimate," which are commonly used practically as synonyms for "living" and "lifeless," respectively But there is no scientific warrant for this point of view, and the problems considered by Prof. Schaefer are essentially problems of matter, not problems relating to the "soul" (anima)

Having given up as practically hopeless the attempt to define life, we may next approach the seemingly easier task of describing life in terms of its most characteristic manifestations. But here also we are confronted with difficulties. The man in the street, if he thinks about such things at all, will, in answer to our inquiry after the most characteristic property of living beings, probably mention their power of spontaneous movement But quite apart from the fact that a large class of living forms—the higher plants—possess this power at most in very rudimentary form, recent developments of science have disclosed purely physical systems—liquid crystals and similar bodies—which manifest seemingly spontaneous motions resembling with astounding closeness those of living forms.

Another property which is commonly cited as specially characteristic of living matter is its power of growth by assimilation from the surrounding medium of matter similar to its own substance. But in this respect also crystals resemble living organism, and the analogy even extends to the formation of new individuals when the "parent" has reached a certain size.

Turning from the physical phenomena of life to the chemical aspect of life processes, a similar observation must be made: the early workers in the field of organic chemistry supposed that the componnds met with in the living organism were peculiar, could be produced only under the influence of a specific "vital force," and were beyond the reach of the creative powers of the chemical laboratory. This illusion was shattered in 1828 by Wohler's synthesis of urea, followed by innumerable further results all pointing in the same direction, and culminating in the recent work of Fischer and others who are building up polypeptides—substances of the nature of the albuminoids and proteids of the living organisms. There seems to be no vestige of evidence that, in order to explain the chemistry of the living body, we must invoke the aid of a specific "vital force"—we have in fact here, apparently, another case of a mere name without objective counterpart.

Having reached this point of view, the question naturally presents itself to our minds, whether living matter itself may not some day be produced in the chemical laboratory—whether the chemist is destined some day to "create" a living thing. Indications are wholly favorable, in Prof. Schaefer's opinion, to the ultimate realization of this, if only we are reasonable in our expectations. It is not a complicated organism which we must look for (even the lowest forms of life known to us *in nature* are highly complex structures), but something exceedingly elementary, to which indeed we may at first hesitate to attribute "life" as ordinarily understood. It must be remembered that the earliest forms of life on our earth were probably quite incapable of leaving any geological record behind them, as they no doubt consisted entirely of soft parts.

There is much in Prof. Schaefer's address which we would like to dwell on at length, but lack of space forces us to pass over with a mere mention those sections of his paper which deal with the more generally known phases of the theory of evolution. His remarks on the cell-aggregate of the higher organism on cell-life and aggregate life, however, call for more leisurely consideration.

"Our own life, like that of all the higher animals, is an *aggregate life;* the life of the whole is the life of the individual cells. The life of some of these cells can be put an end to, the rest may continue to live.

"On the other hand, if a few cells, such as those nerve-cells under the influence of which respiration is carried on, are destroyed or injured, within a minute or two the whole living machine comes to a standstill, so that to the bystander the patient is dead; even the doctor will pronounce life to be extinct. But this pronouncement is correct only in a special sense. What has happened is that, owing to the cessation of respiration, the supply of oxygen to the tissues is cut off. And since the manifestations of life cease without this supply, the animal or patient appears to be dead If, however, within a short period we supply the needed oxygen to the tissues requiring it, all the manifestations of life reappear.

"It is only some cells which lose their vitality at the moment of so-called 'general death.' Many cells of the body retain their individual life under suitable circumstances long after the rest of the body is dead. Sherrington observed the white corpuscles of the blood to be active when kept in a suitable nutrient fluid weeks after removal from the blood-vessels A French histologist, Jolly, has found that the white corpuscles of the frog, if kept in a cool place and under suitable conditions, show at the end of a year all the ordinary manifestations of life Carrel has succeeded in substituting entire organs obtained after death from one animal for those of another of the same species, and has thereby opened up a field of surgical treatment, the limit of which can not yet be discerned."

It is thus evident that in the higher animals the "aggregate life" is closely dependent on a proper adjustment and coordination between the "cell life" of the separate organs. Such coördination is secured by a two-fold mechanism On the one hand by nervous control, and on the other by the diffusion through the system of so-called *hormones.* Nervous control of body-functions may be purely reflex and unconscious, or at least, outside the scope of our will, as is the case, for instance, with heart action in normal individuals. Or it may be more or less directly governed by our will and emotions.

The influence of hormones upon bodily functions is of a somewhat different character. Hormones are internal secretions produced in various glands and poured through various channels into the general circulation. Their action is presumably of the nature of a chemical stimulus. Nervous impulses are apparently carried by propagation along nerve strands somewhat as electricity travels along a wire (though the velocity of a nerve impulse is very much smaller). Hormones, on the other hand, depend for their action on actual convection from their place of manufacture, the internal gland, to the points at which they produce their effect. Among the glands which secrete hormones are various structures whose significance remained a mystery until the function of their substances was understood. Such glands are the suprarenal capsules, secreting adrenalin (the only hormone which has so far been reproduced by synthesis in the laboratory), the pituitary body, abnormal development of which is accompanied by abnormal bodily growth (gigantism), and several others which we can not stop to mention.

Allied in character to the action of hormones is that of antitoxines, protective substances produced by the body in reaction to an invasion by disease germs.

At such times the battle for our life is fought with chemical weapons. The bacteria produce toxins, substances which poison us, while our body produces antitoxins, unconsciously putting out poison for this microscopic vermin, much as consciously we put out poison for larger representatives of the parasite tribe.

The discussion of life and disease naturally leads us at last to the consideration of death. This takes place either through accident, disease, or old age. The first two causes are more or less preventable, perhaps, when science has advanced sufficiently far, wholly so. The last is probably a cause inherent in the nature of life, and unavoidable. But, as Prof. Schaefer points out, a natural death by old age, not hastened nor agonized by disease, should be a quiet, painless phenomenon, unattended by violent change. And if we were all certain of a quiet passing; were we sure that there would be "no moaning at the bar when we go out to sea," we could anticipate the coming of death after a ripe old age without apprehension.

A Natural African Silk

IT is proposed to make a commercial use of a native silk coming from the African region which does not appear to have been utilized heretofore This is a silk found in the Belgian Congo region, and it is furnished by worms of the anaphe, which variety is widespread in the Uganda, the German east Africa, Cameroon and Congo as well as other regions. The African silk corporation has already begun to install plants of the kind in the Uganda and elsewhere, and two other firms are soon to begin work in Belgian Congo. The worms are very voracious and are covered with hairs which have a stinging effect on the skin. They hardly ever change their place except during the night in order to seek food or search for good places for building their nests. They feed on plants such as *Abizza fastigiata,* also *Bridelia micarantha* and others. On the under side of this latter leaf, the anaphe lays 200 or 300 eggs placed in piles and covered with a protecting down. About two months after hatching, the worms proceed to make a combined effort in order to build a kind of nest upon the plants which furnish their food. The nest is of a silky appearance and has a color varying from coffee color to a rusty red. Of an irregular shape, the nests have a size ranging from that of an egg up to a child's head, and they contain from 10 to 100 cocoons tightly pressed together. When the butterfly is hatched, it secretes a liquid which attacks the cocoon and the envelopes of the nest, so that it can find its way to the outside. It appears that this does not injure the silk of the cocoons, so that it is not required to smother the insect within the chrysalis to avoid hatching the butterfly. The nests must be handled under water in order to prevent the nettle-like action of the hairs upon the skin, such hairs and also fragments of skin being scattered through the nest. The silk of the envelopes and that of the cocoons are treated separately, the operation being a washing with carbonate of potash solution until no more color is discharged, then the silk is dried in the air and packages of it are sent to the factories. The yield in the present case is estimated at 1 pound of silk thread coming from 6 pounds of raw silk. It does not seem difficult to carry on silk raising in this case, as the matter of acclimating the silk worm, which is such an important one with the usual kind, does not need to be dealt with here, either for the insect nor for the food plants. No diseases attack the insects, as far as can be noticed.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Mississippi River

To the Editor of the SCIENTIFIC AMERICAN:

Noting your editorial of May 25th, page 475, we would like to present the following solution of the Mississippi problem.

Construct a ship canal as follows:

Leave the east bank of the Mississippi River at some point between Memphis and Cairo.

Parallel the river southward until the highlands east of Memphis are passed.

Then follow the general direction of the contour lines toward the southeast.

Continue through the level plains of Mississippi and southern Alabama into Georgia, dropping gradually through the contour lines toward the Gulf of Mexico.

When a point north of the Florida peninsula is reached, turn slightly to the southward and cross all the peninsular contour lines near their centers or highest points.

Dredge the Alabama River and other streams of importance crossed by this proposed route of ship canal.

Place locks and spillways, at the points where important streams cross the ship canal, so as to regulate water levels and facilitate commerce.

ADVANTAGES TO BE GAINED.

1. Relief to the congested lower Mississippi River at flood time.
2. Regulation of the Mississippi River flow at all high-water periods.
3. The creation of an inland system of waterways which will become equal in importance to the Mississippi River.
4. A limited supply of water for irrigation where needed along the upper portion of the canal.
5. An unlimited supply of flood water for irrigation throughout the entire Florida peninsula in the season of greatest need.
6. Silt and clay sediments to balance the sandy soil of Florida in the fields and on the country roads.
7. Fertilizer where it is most needed.

J. L. GOULD
Fort Myers, Fla. GEORGE M. LUMMIS

America and the Gordon Bennett Cup

To the Editor of the SCIENTIFIC AMERICAN:

The question asked in your editorial of September 14th, as to the reasons for the exceedingly poor showing made by America in the Gordon Bennett Cup race suggests several collateral questions.

1. Is not the greatest difference between American machines and French ones almost entirely a difference in the degree of perfection of details of the machine?

2. Is not this difference almost entirely due to the characteristic of the French engineers and machinery manufacturers of taking infinite pains, even with the most minute details?

3. Is this due to a difference in temperament, or to the difference in the keenness of competition to which engineers and manufacturers are in general subject in the two countries, or to the difference in thoroughness of the superintendents actually in charge of the workshops, or to the fact that the lower cost of skilled labor in France makes it possible to give to the actual work of construction an amount of time that would be prohibitory in this country?

4. Has not our record in aviation thus far been closely parallel to our record in the development of the automobile, where we did much more notable work in the field of invention than in the workshop? We are distancing the world in the third stage of automobile development—that of supplying the world's demand for efficient low-priced machines, and no doubt we shall repeat this performance when this stage of development is reached in aviation.

5. Is not the progress which our inventors and builders have made in hydro-aeroplanes fully as important as the more spectacular achievement of speed?

6. Is not the great need of aviation in America at this time, if we are to prove worthy competitors of the French in speed events, that we by some means attract to it many more engineers who are also skilled shop men and who have not only a high degree of ability, but also the characteristic of taking infinite pains with even the minutest details?

7. Can the money which this requires be secured in any other way than that through which the French builders secured it; namely, through the awakening of the national government to the importance of aviation in connection with national defense, to the point where the government provided the funds for the purchase at liberal prices of the product of the builders, and the liberal patronage of that part of the public who were both ready and able to co-operate financially?

As the pressure of other matters prevents me from being actively engaged in aviation work at the present time, I have written the above from the point of view of "one on the fence" in the hope that it may, as is sometimes the case, suggest some point of value to the real workers who are usually too busily engaged on problems of immediate importance to make general surveys of the field.

New York city. CHARLES M MANLEY

Laces and Flour from Bananas

To the Editor of the SCIENTIFIC AMERICAN

I am an old subscriber of the SCIENTIFIC AMERICAN, which I consider as the queen of all the reviews of this kind.

In the issue of February 17th, 1912, page 151, under the heading "Banana Cloths," is said "It has been left to the Chinese to teach us how the tons of banana fiber thrown on the rubbish heap every year can be converted into banana cloth and sold at a most remunerative price." I take the liberty of giving to you the knowledge that long before the Chinese the Brazilians had utilized the fiber of banana trees for cloth and ladies' garments. I inclose a sample of lace that is sold here for one milreis a meter, which corresponds to about 12 cents a foot in American gold.

Also in your issue of July 13th, 1912, page 23, banana flour is advertised as a novelty in the French industry I send to you one small can of this product, made here by

Lace made from fibers of banana.

us, which like the banana cloth, has been on our markets in Brazil over twenty years.

Though you will not be responsible for statements made in the correspondence columns of your journal, I think I must call your attention to the facts above mentioned in favor of our national industry here.

Para, Brazil. FRANCISCO BOLONHA, C.E.

The Steel Rail Problem

To the Editor of the SCIENTIFIC AMERICAN:

I have read your editorial in the issue of August 24th with a great deal of interest, and some surprise I have been a reader of the SCIENTIFIC AMERICAN for a great many years, and have always found its editorials fair in every way, but in this case I think you are not treating the steel makers fairly when you place all the blame for defective and unsafe rails upon them, when the fact is that the railroads themselves are the ones to blame because they insist in their specifications upon such hard steel, steel which will pipe, and which the most careful examination will not detect A discard or cutting off of 50 per cent of the ingot or bloom would not be sure to discover all of the piping. It is impossible to detect the last tracing of piping by cutting the bloom when it is hot It could only be done by nicking and breaking cold This, of course, is impossible in the regular manufacture of rails.

I am not a rail maker or connected with any works making rails, but for over forty years I have been connected in different capacities with the manufacture of open hearth and Bessemer steel in this country, and, therefore, feel that I ought to know something about it

Ever since the manufacture of melted steel was begun by Huntsman in Sheffield, more than one hundred years ago, one of the greatest expenses of the process of making high carbon steel has been caused by the piping and the waste occasioned by the steel makers being obliged to top the ingots, that is break them cold until every trace of the pipe is removed. In many cases over one half of the ingot is removed before this has all disappeared. This seems to be as much of a problem with the tool steel maker to-day as it was forty years ago, and this trouble is had with ingots of very small section; most of them 4 to 6 inches square. The piping increases with the size of the ingot, which in most rail mills to-day are from 18 inches to 22 inches square.

You say the steel makers are to manufacture the kind of steel that suits their particular whim. It is many years since they have been allowed to do this. Detailed specifications as to every detail of the manufacture are made, and the inspectors watch day and night to see that the specifications are carried out to the letter, in many cases almost taking the manufacture out of the steel makers' hands.

You say in your article that it is well understood by engineers that it is possible to produce a rail that will stand up under very high speed traffic, and that the failure to produce them is entirely due to the rail makers themselves

I would like to see proof that this is well understood by engineers You will, I think, find that the general opinion of engineers is that the rails are made strictly to the railroad's own specifications, and that, therefore, the fault lies with them

Now the question is, what is the remedy for all this trouble? The answer is very simple, make steel that is low in carbon and phosphorus that will pipe very little if at all This can be done, but if this is proposed the railroad men immediately say that they will have a rail that will not wear well, they will wear out in a very short time, so they insist on having a hard and consequently brittle rail, and take the risk of broken rails, costly wrecks and the killing of passengers

Much is being learned lately about alloyed steels, and we now know that there are other hardeners that can be used besides carbon that do not cause piping, but these will increase the cost of the steel somewhat, which the railroad companies would probably object to First cost seems to be all that the average purchasing agent thinks of

So it boils down to this—the railroad company in order to save money in renewals insist that the steel maker give them rails that they (the steel makers) know are brittle and unsafe to use, saying in effect "That's none of your business; we will take the risk," and they do, and they and the travelling public pay the bills

You do not seem to think that the present schedules of the fastest railroad trains are too fast for safety In this you do not agree with many of the best railroad men in this country I feel sure they have more than reached the safe limit, and many a railroad man will breathe easier and thank God when such trains as the 18-hour fliers between New York and Chicago are cut down in speed, as they ought to be at once. I speak with a great deal of feeling on this subject because the craze for high speed in railroading has cost me the lives of a dearly beloved brother and two others of the leading men of a large manufacturing concern with which I am connected

Cleveland, O S T WELLMAN.

Gyroscopic Action of Revolving Aeroplane Motors

To the Editor of the SCIENTIFIC AMERICAN

Less than two hours before the accident that killed Paul Peck I had a talk with him on the subject of the danger in gyroscopic force He admitted that at times this force had caused him considerable trouble, but said that he did not believe it to be particularly dangerous I explained to him several conditions that would excite gyroscopic force in his motor to a point where it would become highly dangerous, and told him that should he ever meet one of these conditions he would be at once convinced that I had not over-estimated the peril, but that he would then be in the same fix as the other fellows that have gone before *not able to tell about it!* The newspaper accounts of the accident say "No one but Paul Peck could tell exactly what caused the accident"

I had just examined Peck's new machine and told him that he would have to be extremely cautious in the use of his controls as it, in my opinion, would be highly susceptible to the elevator and would rock lightly about its lateral axis You will notice by the newspaper accounts that after his first flight he spoke particularly about this very feature, and it was no doubt one of these sudden dips that excited gyroscopic force and caused the spiral movement in his machine I found three eye witnesses, not one of whom was an aviator, who distinctly saw Peck turn his controls contrary to his path of flight, but in all the accounts of the accident, given out by the aviators, not one of them mentioned the fact that the machine spiraled with its *rudder turned to the outside of the circle* and *pitched downward with its elevator raised to the limit!* Nor did any one think it worth while to mention that during all this time the motor was spinning at top speed; yet these three features of the accident, completely ignored in all published accounts, show the real cause and prove the brutal strength of this force when once it is set in motion

Peck said that while he did not believe there could be any great danger from gyroscopic force, he was open to conviction and asked me to bring out to him on the following afternoon a copy of my new article on the subject. I was there with the copy at the appointed hour, but too late to save the poor fellow

How much longer are they going to fight against the truth? How many more lives must be sacrificed before they will understand?

Chicago, Ill. THOMAS PRESTON BROOKE.

Professor Dr. Paul Walden

By Dr. George F. Kunz

LE ROI est mort, vive le Roi! Now that the Eighth International Congress of Applied Chemistry has come to a close our thoughts naturally turn in anticipation to the next, the Ninth Congress and its recently appointed president; for, upon the retiring of Dr. Nichols from this office, it became incumbent upon the Congress to elect a new president in his place.

The man upon whom this choice has fallen is Prof. Dr Paul Walden, a Russian by birth, and director of Polytechnicum at Riga. The present seems a fit occasion briefly to review the life of the chemist who will preside over the Ninth International Congress which is to assemble in 1915 at St. Petersburg, Russia.

Paul Walden was born near Riga on July 27th, 1863. He received his early schooling at the Realschule in Riga and thereupon entered the Polytechnicum, where he studied among others under Ostwald, who numbers him among his most brilliant pupils. In 1885 he was appointed assistant in the Department of Physics and was transferred in 1888 to the Department of Chemistry. He received his appointment as Professor of Analytical and Physical Chemistry in 1894 and was raised to a full professorship in 1896, being at the same time appointed director of the Polytechnicum. This is the office which he holds at the present time.

Prof. Walden has been a most prolific worker in the field of chemistry and physical chemistry. A list of his publications would fill several columns of these pages. Among the subjects to which he has given his very special attention may be mentioned particularly stereochemistry and the closely allied subject of optical activity. Those of our readers who perused the biography of the great van 't Hoff in our pages some months ago, will remember that stereochemistry, which may be said to owe its birth to van 't Hoff, is that department of the science which deals with the representation of chemical substances by means of three-dimensional formulæ or, to use the words of the title of one of van 't Hoff's own publications, with the arrangement of the atoms in space. Van 't Hoff, too, it was who pointed out that optical activity is closely related to the stereochemical properties of the compounds which display this property of turning the plane of polarization of light traversing them. A great mass of experimental data on this subject has since been collected by many workers in the field, among which must be mentioned such men as Walden, Landoldt, Frankland, and others.

Apart from his more strictly scientific research work, Walden has also contributed a number of very excellent biographical sketches of great chemists. Of these perhaps the most valuable of all is his life of Ostwald, of which Ostwald himself is reported to have said that he owed fifty per cent of his reputation to this biography.

The high attainments of Prof. Walden and the remarkable work performed by him have been officially recognized by the bestowal upon him of many orders and other honors. Prof Walden speaks fluently the Russian, Livonian, French and German languages and has considerable familiarity with English and Italian also. He is a fluent and ready speaker and his delivery is dignified and impressive. He speaks directly to the point, with carefully chosen words by which he knows to attract and maintain the close attention of his audience. His expression is invariably clear and leaves no doubt as to his meaning. As is commonly the case, clear thinking in him finds corresponding expression in his words, which accordingly carry conviction to the minds of his hearers.

Prof. Walden is in many respects peculiarly adapted to function as presiding officer for the Ninth Congress of Applied Chemistry. When we consider the complex composition of the body which will assemble, made up as it is of as many, or perhaps more, countries than there are chemical elements, well may we say that no one is better qualified than Prof. Walden, with his intimate knowledge of the art of combining and arranging the various chemical elements, to blend into one homogeneous whole the many heterogeneous components which will be united at the next Congress. Many important subjects will have to be considered, among them whether the annual reports of the International Commission of atomic weights shall be used solely for scientific purposes, or shall be made the basis of technical determinations. The Congress is to determine on some general rule which shall be followed universally, thus doing away with a great deal of unnecessary confusion. The Eighth Congress recommended the adoption of standard methods of examination of ores, metals and fuels; the Ninth will have to decide on the acceptance of the project for an International Center of Congresses with permanent headquarters at the Hague, the proper selection of International delegates, the best arrangement of the papers to be read, and many other points.

Prof. Dr. P. Walden

President of the next International Chemical Congress.

It is due in no small measure to the splendid leadership of the retired president, Dr. William H. Nichols, that the recent Congress proved such a complete success and closedwith absolute harmony; and we have every cause to be optimistic in our expectations with regard to the equally successful course of the impending Ninth Congress.

The honorary president of the Ninth Congress will be Prof. Dr. Demetri Kamovaloff, the nestor of Russian chemists and Professor Emeritus of the University of St. Petersburg, Russia.

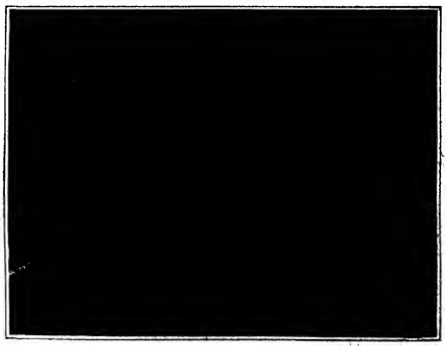
A 10,000-ton Motor-driven Ship

THE arrival of the "Christian X," the first large ocean-going, motor-driven ship, at New York marks another important step in the development of transatlantic travel, an advancement of greater significance than any that has been made since a steamship first crossed the Western Ocean. Had the "Christian X" been a smaller ship of slower speed, and driven by motors of moderate power, the successful passage just accomplished would not be so full of meaning. As matters stand, no one can deny that the era of the motor-driven ocean liner has now been fairly well launched, and the question of applying the oil engine to the propulsion of the fastest and largest of transatlantic liners is henceforth merely one of mechanical development; the 25-knot, 50,000-ton ship is clearly within sight.

The "Christian X," which was built by Burmeister & Wain, Ltd., of Copenhagen, and is owned by the Hamburg-American Company, is a freight and passenger vessel, whose length is 370 feet, beam 53 feet, and maximum draft 24 feet, at which her displacement is 10,200 tons, and her dead weight carrying capacity 5,500 tons. She is driven by twin Diesel engines of a combined maximum indicated horse-power of 2,500.

The first motor-driven freight and passenger ship to arrive at New York.

Twin motors of 2,500 combined horse-power drove this ship from Hamburg to Havana, 4,627 miles, at a speed of 11.1 knots and with a consumption of 0.84 pound of oil per horse-power per hour. Note the absence of smokestacks.



The twin motors of the "Christian X," each of 1,250 horse-power.

A steam plant would reduce the cargo capacity of this ship by 20 per cent. The saving due to the oil motors is $18,000 every 100 days.

Each engine contains eight cylinders, 20¼ inches in diameter, and 28¾ inches stroke. In each cylinder head are four valves, respectively for the air admission, fuel admission, the exhaust, and for starting by compressed air. The charge is ignited, on the well-known Diesel system, by the heat of compression, the air being compressed to 475 pounds and corresponding temperature of 650 deg. Cent. In starting the engines, compressed air is drawn for the purpose from two reservoirs at a pressure of 300 pounds to the square inch. The compressed air is utilized for the first three or four strokes, when the air supply is cut out and the oil supply cut in.

There are two auxiliary engines, one on the outboard side of each main engine. Each is a four-cylinder, Diesel motor of 250 horse-power and each is connected to a dynamo for furnishing electric light and power, and to a four-stage air compressor, which is used for supplying air at 300 pounds to the two reservoirs used in starting the main engines. The air for atomizing the oil is further compressed to 900 pounds to the square inch.

The main engines are controlled from the starting platform by means of a lever and a wheel, the first regulating the oil supply, the second the reversing. The reversing gear and the general mechanism for operation of the valves are among the most successful features of the design. We are informed by the chief engineer that, during the tests, with the engines running full speed ahead, the port engine was changed to full speed astern in 10 seconds' time, a remarkable result in an engine of 1,260 horse-power.

That the first Atlantic crossing by a motor-driven ship of large size has been achieved with perfect success is shown by the following facts: The "Christian X," with a full load aboard, left Hamburg July 23rd, and reached Havana August 9th, having covered 4,627 miles, without a stop, at an average speed of 11.1 knots. The chief engineer informs us that the weather was decidedly bad from the 28th of July to the 5th of August, with winds of from 7 to 8 strength, and a sea which caused the ship to pitch and roll heavily and take much water on deck. The propellers were frequently out of the water; but the Aspinall regulator, which acts directly on the oil feed, gave excellent results, as may be judged from the fact

(Concluded on page 282.)

The Discovery of a New People

Stefansson's Blond Eskimo of Victoria Land

As late as 1906 Victoria Land, a large island that juts out into the Arctic Ocean, north of Canada, was supposed to be uninhabited. Of the mainland to the south nothing more was known. The coast between Victoria Land and the mainland had been skirted by water no less than four times—in the twenties of the last century by Dr. Richardson; in the forties; in the fifties by Capt. Collinson, and by Amundsen in 1905 during his Northwest Passage expedition. Because the members of these four exploration trips saw little of the land, and because they met no Eskimo on the ice, geographers and ethnologists had all but accepted the belief that the entire country east of Cape Parry to Coronation Gulf was uninhabited. The western or Baillie Island Eskimo had never penetrated farther east than Cape Lyon, and knew nothing definite about any tribes beyond Cape Lyon. Indeed, they regarded the entire country to the east as uninhabitable for lack of food.

Stefansson Seizes a Brilliant Opportunity.

Here was a *terra incognita* that seemed worth a careful scientific survey. Even though it were uninhabited, its geology, its fauna and flora were well worth study. Mr. V. Stefansson of the American Museum of Natural History decided to explore the country. With the financial aid of the Museum and of the Geological Survey of the Canadian government, he organized an expedition. Associated with him was Dr. R. M. Anderson, a biologist of note. In 1908 the Stefansson-Anderson expedition left New York. Proceeding first to Winnipeg, and thence to Edmonton, the explorers went down the Mackenzie, and eventually reached Herschel Island at its mouth There they expected to pick up supplies For the first time in twenty years ships found it impossible to penetrate the summer ice to the east of Point Barrow It was impossible to proceed at once to Victoria Land Stefansson had to journey to Point Barrow, in order to obtain matches, tobacco, tea, and other necessities for a protracted stay in an unknown country Although a whole year was thus lost (the distance between Herschel Island and Point Barrow is hundreds of miles) the diversion was not unprofitable. The region about the mouth of the Colville River is scientifically almost virgin field for the geologist and biologist Accordingly, Dr Anderson and Mr Stefansson improved the opportunity to make a study of the country

The expedition began the work that it set out to accomplish in 1910. On April 27th of that year, Mr Stefansson with three Eskimo companions started east from Cape Lyon—the most easterly point at which Eskimo houses were seen by Dr Richardson on his Franklin search expedition, and the most easterly point known to have been visited by Alaskan Eskimo That the region into which the explorers went was not always uninhabited was proved by the ruins of villages, abandoned by Eskimo not more than half a century ago, and that the tribes who had once lived in the villages engaged in whaling was in turn proved by the bleached vertebræ of whales strewn about.

The Discovery of a New People.

As Stefansson and his companions journeyed farther east the evidences of more recent occupation of the territory became stronger At Point Wise freshly cut wood was found; at

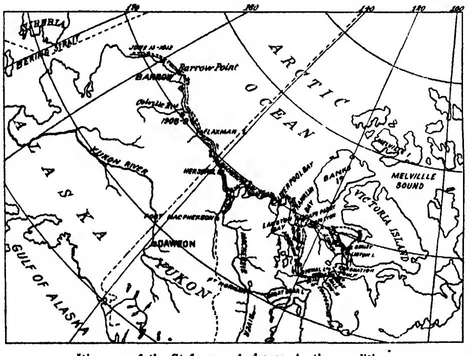
(Concluded on page 269.)

A red-bearded blue-eyed Eskimo.

Mr. Stefansson discovered a tribe of forty European-like Eskimo north of Cape Bexley.

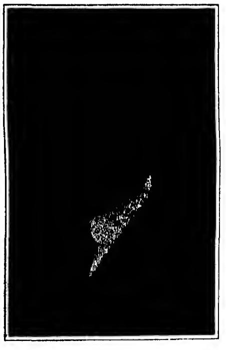
Eskimo helping Mr. Stefansson break camp and pack the sleds for the journey.

Among the one thousand Eskimo of Victoria Land are some who have blue eyes and blond hair The type is so markedly European that it will be a matter of considerable interest and importance to determine whether or not it is the result of an admixture of Scandinavian blood



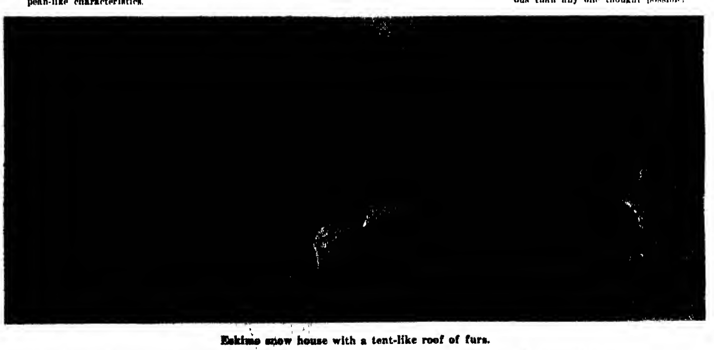
Itinerary of the Stefansson-Anderson Arctic expedition.

In late April, 1910, Mr. Stefansson and Dr. Anderson left Cape Lyon, the most easterly point visited by the Mackenzie River Eskimo. The region to the east of Cape Lyon has long been supposed to be uninhabited, for the coast had been skirted by water no less than four times in less than a century and no inhabitants reported On Dolphin and Union Strait Mr Stefansson discovered a tribe of Eskimo unknown to anthropologists In May Mr. Stefansson crossed over to Victoria Land, where he discovered Eskimo with European-like characteristics.



V. Stefansson.

The results of his expedition were extraordinary. "We have covered the last mile geographically that we set out to cover," says Mr Stefansson, "and have found what we set out to find—a 'new people,' less contaminated, more numerous than any one thought possible."



Eskimo snow house with a tent-like roof of furs.

All the coast of Dolphin and Union Strait was inhabited by Eskimo in former times, but now the most westerly group is the Akuliakattagmiut, near Cape Bexley, discovered by Mr. Stefansson. The camp sites of this tribe are found on every hilltop east of the Coppermine. Until they were visited by Mr. Stefansson these Eskimo had never seen a white man.

Illustrations by courtesy of the American Museum of Natural History.

Farm Electric Lighting by Wind Power

A Complete Lighting Plant Installed for $250

By Putnam A. Bates, E.E.

IN traveling over a vast area of country as I have in connection with my engineering work for the past fifteen years, I have encountered many interesting installations where electricity plays the important rôle.

The importance, however, is not always measured by the size of the installation, and as an illustration of this is the wind power electric plant on Mr. J. F. Forest's farm at Poynette, Wisconsin. This ingenious, but unpretentious equipment, this farmer installed himself. He set up the mill and erected the dynamo, storage battery and shafting. In fact, he did all the wiring throughout his entire group of buildings at a cost that did not exceed $250, including lamps, switches, battery cells, insulators, wire, dynamo, windmill—everything. This I call a real achievement and an evidence of the simplicity of electrical apparatus. Located as it is in a farming community about twenty-five miles from Madison, Wisconsin, this farm is no different from many in that district. The property comprises a tract of some hundred or more acres, and the "routine" is about the same as elsewhere on thousands of farms.

Mr. Forest, however, is unusual—he has the gift of imagination which enables one to see things completed before they are begun. He was watching one day an old windmill pumping water on his place, and without understanding much about electricity he made up his mind that if revolving the "armature" of a dynamo "made" electricity, this mysterious force could be produced on the farm by wind power just as it is in factories and city establishments where steam or gas engines are utilized, to furnish the initial energy.

So this farmer set about his task with a will, and the accompanying photographs show that he accomplished what he set out to do.

While there are other wind power electric plants, and Mr. Forest cannot claim the distinction of having the first such installation, his has been marked with success. And this example may well be followed by many other farmers who can appreciate the advantage of legitimate improvement. A brief description will, therefore, be of interest to those who may be contemplating a venture in this direction.

The power windmill shown (Fig. 1) is twelve feet in diameter. It is geared so that the vertical shaft makes five revolutions to one of the windmill. This shafting extends down the center of the tower and has attached to it pulleys, bevel gears and a set of grinder rings. This mill is not used for pumping, as it is "rigged" only for ordinary mechanical power purposes requiring rotary motion. The economy of such a piece of apparatus will be understood when I state that besides running the electric dynamo for which it was primarily installed, it takes its turn at operating a drillpress, grindstone, cornsheller, beehive saw, washing machine, grain elevator, and a feed grinder.

The feed grinder is of the combined foot-gear type, and as the speed dies down the rings clear themselves, leaving them in a condition to start up easily when the wind rises. A clutch is used to start and stop the grinder by itself. Above this is a spring. In case a nail or any iron is present in the grain the grinder is immediately disconnected, thus avoiding the possibility of damaging the mechanism.

An elevator lifts the grain into a large hopper above the grinder, and this also is started and stopped by a clutch.

Another feature of the grinding arrangement is a set of flour rings which will grind graham flour, cornmeal, and buckwheat flour. Connection is also made with a wheat scouring machine and a small "bolter." Thus, on this farm the miller's profits are saved. There is no teaming to the grist mill and hauling feed back again. The flour for home use is made from selected grain, and choicest ears of corn are put into meal for the "johnny cakes."

Many a farmer would do well to follow this man's example. Such a wind power is indeed worth the investment, as it aids in decreasing the cost of home living. This, however, is not what prompted its installation. Mr. Forest wanted electric light, and he went the right way to get it. These other advantages were merely "thrown in."

Many people say that a farmer cannot afford luxuries or comforts—that they cost too much for him. But, let us test this statement and see if there is any truth in it. Four acres of potatoes properly planted and cared for will yield a crop of 1,000 bushels, and the cost of plowing, planting, cultivating and harvesting will not reach $50 per acre. Assuming the crop is sold at no more than fifty cents per bushel, we can place to the profit of this little patch the sum of $300, and if the four acres is selected on a portion of the farm which generally is little used this is clear gain; consequently, the farmer can at least make improvements on that amount.

Fig. 1.—This windmill drives a dynamo which furnishes a current for twenty-four tungsten lamps.

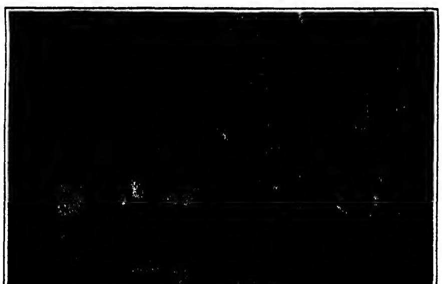


Fig. 2.—The dynamo capacity is 0.21 kilowatt. It is placed on the second floor of the mill, and driven by a quarter-turned belt from a pulley on the vertical shaft of the wind power.

Fig. 3.—Storage battery is in the adjoining barn and accumulates energy given by the dynamo when running, and stores it for use when lights are turned on.

FARM ELECTRIC LIGHTING BY WIND POWER

The dynamo (Fig. 2) of Mr. Forest's electric plant is placed on the second floor of the barn building, which forms the base of the mill housing. Its capacity is 6 amperes at 35 volts, or 0.21 kilowatt, when driven at a speed of 450 revolutions per minute. It is run from a horizontal pulley on the upright shafting, and is operated by a clutch and quarter turned belt, passing over an idler pulley, thus doing away with the need for bevel gears.

Sometimes in a high wind the mill will "race" the dynamo, speeding it up to perhaps 600 revolutions, but to meet this condition two different sizes of pulleys have been used, making it possible to slip the belt from one to the other according to the velocity of the wind prevailing. All intermediate variations in speed are taken into consideration by the automatic control mechanism which is well deserving of mention.

There is an automatic cut-in between the generator and the storage batteries, which cuts in as the speed runs up, and again drops out as the speed slows down, thus preventing the electric current from plowing back into the generator and injuring it through a reversal of its "polarity." This cut-in, therefore, plays a very important part in a windmill driven plant on account of the sudden wind changes. The "cut-in" being entirely automatic, it is kept in a cabinet under lock and key.

The storage battery in this particular installation has fourteen cells, each cell giving about two volts, and the capacity of the battery being rated at 60 ampere-hours, or enough current for one carbon lamp for 120 hours. The battery is in a separate room in the barn, some distance from the dynamo.

When a potential of 25 to 35 volts is used for an electric system of this kind we call it a "low voltage" plant, and the lamps must be bought for this low voltage, as they were in this installation.

There are, in all, some twenty-four lamps, placed as the owner figured he would need them, and his judgment in this I find was very good. For example, he placed several lights outside the various buildings that he might see his way around and be able to direct his course accordingly. Such a provision also offers protection in the case of dealing with persons having no right to enter the premises. All these outside lamps are controlled by switches placed within, and on a cold winter's night it is not necessary to go outside when the dog barks. A turn of a switch and a glance through the window will generally be sufficient to determine the cause of any disturbance.

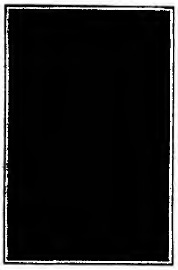
The Passing of the Punkah

ONE can hardly imagine the hot countries of the Far and the Middle East without the punkah, and it is something of a shock to learn from the American consul general at Hongkong that in that colony, at least, the punkah is rapidly giving place to the electric ceiling fan. Few new buildings in Hongkong are fitted with punkahs, but all are wired for electricity with reference to the use of electric fans. According to the consul general, while punkahs have many merits—especially in being easily regulated so as to maintain a gentle breeze—they entail a serious loss of light, do not promote active ventilation, as a fan does, and are hard to keep clean.

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.

A Curiously Eroded Stone

A VERY remarkable example of erosion is shown in the accompanying photograph. The specimen is a single piece of stone that has been ground into a fantastic shape by natural causes. The stone was picked up by an old Indian on the shores of Lake Superior last summer. It was lying, when found, in the natural pocket which formed it. It would have been most interesting to note the probable eddies which caused it to grind itself into its present shape.



An oddly eroded stone.

A thirty-foot ice column.

Photographing a Tornado

WE frequently hear of the daring of photographers who expose themselves to real dangers in order to obtain unique and interesting photographs. An example of such daring is shown in the accompanying engraving. Last May a tornado occurred in Oklahoma which devastated a section of country near Poca City, killing a number of people and destroying much property. Notice of the approach of the tornado had been telephoned ahead, which gave an enterprising photographer the chance to prepare to record the phenomenon with his camera. He took the photograph which is reproduced herewith, from a house which lay directly in line with the approach of the tornado. The picture clearly shows the funnel-shaped cloud formation. Immediately on snapping the shutter the photographer took refuge in a cave, and as the tornado came on, it completely demolished the house from which the picture had been taken.

Photograph of a tornado taken from a house that was wrecked a moment later.

Humane Method of Slaughtering Animals

THE accompanying photograph shows an up-to-date and humane method of slaughtering animals, which is now being used largely in England. The instrument employed is known as the Behr pistol. It is a spring-operated device that projects a sharp blade into the animal's head. No bullet enters the animals, and as no powder is used, the pistol may be placed directly upon the vital point of the skull so that the aim will be unerring, death will be absolutely instantaneous, and the animal will feel no pain. A similar instrument, but of smaller pattern, is made for use on dogs, pigs, sheep, and other small animals.

Slaughtering a steer with a bulletless pistol.

An Abbreviated Diver's Helmet

FEW people realize how utterly helpless a diver is when clothed in the ordinary diver's suit topped with the heavy brass helmet. The air that is pumped down to him fills not only the helmet, but the entire suit, puffing it out to such an extent that heavy weights are required to keep the man down. The diver cannot possibly move about like the swimmer, but must signal to the tenders above when he wishes to be raised or lowered. The gloves upon his hands are cumbersome, and the work that he can do is really very limited. One of the annoyances that he has to endure is the fact that he cannot reach inside of his suit to ease any discomfort. We have read of a diver who discovered a June bug in his helmet when he was down under water, and he was obliged to endure all the torture of having the insect crawl over his face without any possible means of reaching it to destroy it or even brush it away.

Evidently conditions such as these influenced a French inventor to devise a diver's outfit which dispenses with everything but an abbreviated form of helmet. As shown in our illustrations, the outfit consists of a cap of rubber which fits closely over the diver's head, covering his ears so as to prevent water from entering them. There is also a strap that fits over the mouth and bears the air supply device Air is pumped to the diver in the usual way, through a pipe which is attached to his helmet at the back of the neck Thus equipped, the diver does not require any great weight to hold him down. He can readily swim down to the work and swim up again to the surface To assist him in descending he is provided with a weight, which he carries in his hand. This is tied to a cord, by which it may be recovered when the diver discards it Having far greater freedom than the ordinary diver, he can do far better work under water

A simplified diver's helmet that dispenses with an inflated suit.

Diving down to the work as free as a swimmer.

A Stalagmite of Ice

IT is not often that one sees a column of ice in the woods standing thirty feet in height like a ghostly white monument Such a column was recently to be seen in the vicinity of Schroon, New York The column had the appearance of a stalagmite of dazzling whiteness and it proved to be a hollow pillar The causes that gave birth to this beautiful column of ice were simple enough, although to the uninitiated the puzzle was extremely baffling The monstrous stalagmite stood about halfway between an old stock farm and the mountain reservoir which supplied spring water to the house and barn. A vent plug was removed, permitting a fine jet of water to shoot up thirty feet into the air and gradually build up a hollow cylinder of ice The column proved a great attraction, and created widespread interest People came from miles around to see the curious spectacle.

Mufflers for Aeroplanes

RECENT experiments with a muffling box on board an aeroplane which were made near Paris proved quite successful It is recognized that the great noise of the motor has its drawbacks, as it lessens the comfort in flying and fatigues the pilot as well as causes annoyance to passengers In military work, the noise prevents the officers from hearing sounds which come from the ground, and these would often be a useful factor in observations. Pilots cannot use their voices to any extent. Another point is that were the motor silent running, the observers could hear sound signals coming from aeronautic quarters, and could also return signals to the ground, by using trumpets of different pitch or sirens as are used on vessels. The present tests were made at the Astra aeroplane establishment near Paris with excellent results, using a biplane fitted with a Renault motor of the 50 horse-power type placed toward the front. The motor has two sets of 4 cylinders each, and the gas is taken from each set by a 2-inch copper tube and is sent into a common muffling box This last has a 6-inch diameter and 30-inch length and was taken from a Renault 14 horse-power automobile It is mounted underneath the aeroplane, and the gas escapes from the box by a 2-inch copper tube placed so as to direct the gas toward the rear The tests took place before a military commission, and during the flights it is said that the noise of the motor was much reduced so as to allow the pilot Labouret to speak to the persons on the ground when he was flying at 300 feet The muffler box does not overheat owing to the strong air cooling which it receives It is intended to use another box which is better suited for the power of the motor, and it will be mounted below the upper wing of the aeroplane The loss of power is below 2 per cent, as shown by measurements

A Unique Exhibition

A UNIQUE exhibition took place recently in Leipzig, Germany An amateur of Chemnitz has built up the battle of St. Privat in all its details with the aid of 14,000 tin soldiers To give an idea of the work required, it may be mentioned that it took fully six years to complete the grouping

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

An Electrical Scoreboard

A NEW scoreboard has appeared, a very large apparatus with figures and names of such dimensions that they may be plainly read from long distances, the face board being 16 feet square. In the center of this is a well defined field, 8 feet square, of copper wire, painted green, with the "diamond" of light brown. Beneath this field a thousand lights are so ingeniously arranged that a continuous line may be described to any part of the field. Thus any combination of movements of field men (in white lights), of player (in green lights), and of the ball (in red) may be shown, all working simultaneously, the different colored lights assisting in the quick understanding of the "play."

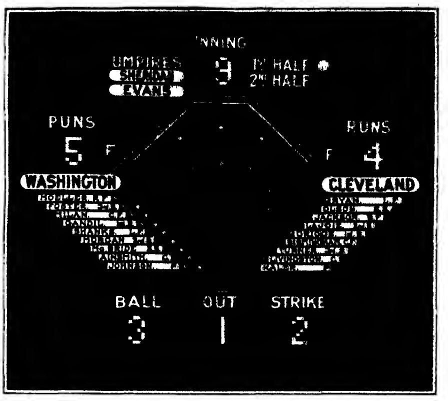
The unique feature of the electrascore and the one which marks it as essentially different from other similar devices, is that the ball and the players are in constant and actual movement all the time. It is not merely a jump from base to base, etc., but a line of light showing the path of the men is flashed across the field. In like manner the course of the ball is followed from pitcher to batter, into any field, to any fielder or baseman, etc.

Beyond the screen field the face board is taken up with boxes for innings, balls, strikes, etc., in figures of lights fully 14 inches tall. The half innings are designated by a big light. The names of the men of the contesting games are amply large, beside which stands a "lightman" to designate those who will be called to the bat. The other team is dark until its time arrives to take the bat. When a man is called to the bat, the "lightman" at once proceeds to walk from his name in an actual path to that post. From this it may be readily realized that 1,500 lights of four candle power were none too many in the construction of this invention.

The rear of the board is a marvel of condensation of levers, switches, stops, etc., for making connections with figures, the ball and the man. The many thousands of feet of wire combining the various lights are gathered in several heavy cables and then redistributed to their proper points of contact. The operator plays the game on a miniature copper scoreboard, making the contacts for movements with the stubs. This may be considered a replica of the field on the face board.

The economic and convenient arrangement of the scoreboard is one of its merits. Twenty-three thousand feet of wire traverse the device in a skillful manner. The entire weight is estimated at a ton. The face board stands up-right, with the rear construction, though amply large, well concealed from the spectators. The voltage necessary may vary from 210 to 220, with the latter preferable.

The easy manipulation has simplified matters for the operator, despite the fact that so much is described on the face.

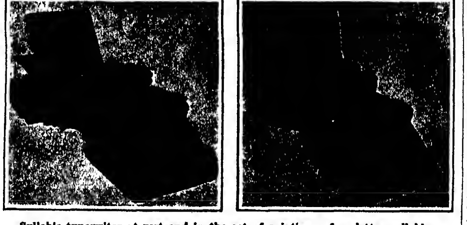


An electrical story of the ball game.

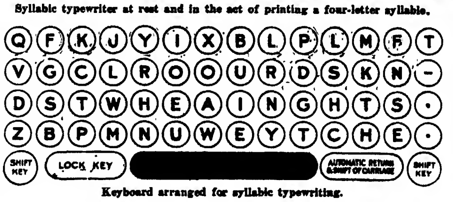
The invention is provided with telegraphic connections, which may come direct from the field of the game or a local wireless station.

While the Nokes electrascore is perhaps best appreciated in a theater, where it may be readily adjusted for exhibition purposes, it may also be set up in the open, if given sufficient space. It is scarcely possible to suspend the device on the outside of a newspaper building, as most of the smaller score boards are done at present.

In other devices of this character, the aim has been to give the *result* or *final* of a movement of a man from base to base or the course of the ball from the pitcher to the batter or one man to another. As to the details which bring about this result, the baseball fan at the scoreboard is ignorant until he reads the newspaper. The electrascore, however, accomplishes this through the maze of lights under the screen field. It is this feature that causes the fascination for this counterfeit game. Especially is this true when baseman, player and ball are having one grand scramble to gain the point, on which may hang the victory or failure of a team.



Syllabic typewriter at rest and in the act of printing a four-letter syllable.



Keyboard arranged for syllabic typewriting.

Machine for Typewriting by Syllables

THE idea of syllabic typing must be as old as the idea of the typewriter itself. Our words are made up of syllables uttered singly or in combination. Each syllable represents a single vocal impulse. Why not print the entire syllable at a single manual impulse, permitting the separate fingers to take care of the separate letters which are combined to produce the syllable. If this could be done it would take less time to typewrite a thing than to speak it, particularly if the machine could be arranged to print even more than one syllable at a time.

A rather promising machine of this type has recently been brought out by an Italian inventor, Mario Schiesari, of Turin. Reproduced herewith is the arrangement of the keyboard. The keys for figures, punctuation marks and various other symbols are not shown, although they are provided in the machine.

In operating this machine the typist works from left to right. The type are arranged in groups on sectors and all the characters arranged in a single vertical row on the keyboard are to be found on a single sector. Thus, taking the first row which consists of the Q, V, D, and Z, it would be impossible to print both Q and D by depressing the key in the first vertical row. To print QD it would be necessary to depress Q in the first row with the left hand and D in the tenth row with the right hand. To write the word "owe" the typist depresses the key O in the sixth row, W in the seventh row and E in the eighth row. It will be observed that the keyboard is so arranged that practically any spoken syllable may be typed at a single stroke. Where this is impossible the syllable has to be divided and printed in two strokes.

The number of letters which may be typed at a single time depends upon the number of sectors. If one had fingers enough he could print an entire horizontal row of keys at a single operation. However, ordinarily an eight-lettered syllable, such as the word "thoughts" represents

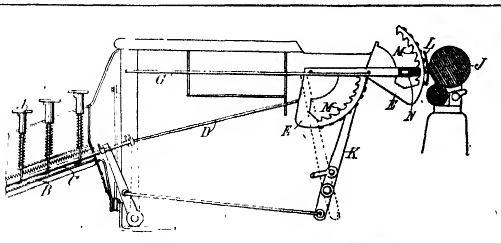


Fig. 1.—Details of the key action and type sectors.

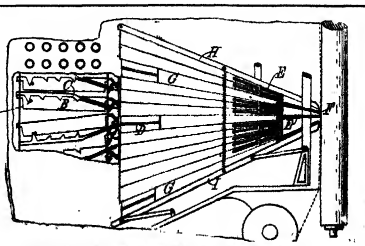


Fig. 2.—Plan view showing the tapered slides.

maximum extent of a single printing. The printing is not done when the keys are depressed but when they are released, it is not necessary to strike all the letters of a syllable at the same instant. The keys may be depressed successively. As each key is depressed it turns the sector until the corresponding character is to be brought up to the printing position. The depressed keys will be held automatically in set position until the last key is released. Then, as all the keys return to normal position, the printing of the entire syllable will be accomplished and the carriage will be moved correspondingly to receive the next syllable of the word. When the last syllable of a word is struck the space bar must also be depressed, so as to allow for the space between the words.

Part of the mechanism employed in the syllabic typewriter is shown in the accompanying drawing. When the key *A* is depressed it rocks the plate *B*, removing a pin *b* from contact with a tooth on the sliding plate *C* and permitting the latter to move forward under action of a spring until one of its teeth engages with the stem of the key. By referring to Fig. 1 it will be observed that the lower end of the stem is bent to form a hook which catches under the tooth referred to, and holds the key in depressed position. The forward movement of the slide plate *C* is communicated through the rod *D* to the type-bearing sector *E*. The relative position of the stem of the key and the tooth on the plate *C* that engages it is such as to swing the corresponding type on the sector *E* to the printing position. By referring to the plan view (Fig. 2) it will be seen that each sector is carried by a slide *D* of tapering form, so that the entire series presents the form of a fan. When a slide *G* is moved forward, carrying the sector to the printing point, owing to its tapering form it crowds to the right all the slides *D* that lie on the right. The slides are prevented from moving to the left by a fixed bar *H* while the bar *I* on the opposite side is yielding and is connected by a pair of links to the frame of the machine, so that when it is displaced from normal position, it has a parallel motion. Any number of the slides *D* may be moved forward to the printing point, causing the bar *I* to yield correspondingly. The taper on the bar *D* is so chosen that the displacement to the right causes the sectors to come to the printing point *F* side by side. On release of the last key, the sectors are moved simultaneously against the platen *J* by means of a bar *N* and arm *K* which are actuated either by a small electric motor or, as in the model illustrated, by a spring motor. Just before the type strike the paper an inking ribbon *L* is swung up between the platen and the sectors. It will be observed that the sectors *E* are provided with notches *M* which are adapted to be engaged by locking bar *N*. This insures proper alignment of the type. The ratchet mechanism that moves the carriage to the left is controlled by the movable bar *I* and hence will move the carriage through a space equal to the number of characters printed. As a motor is used in connection with the machine, power is used to return the carriage to the right for a new line, on depressing a carriage shift key.

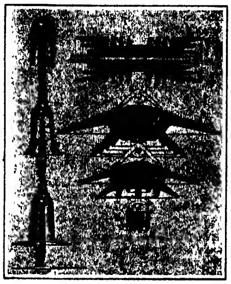
Graded Suspension Insulators

To the Editor of the SCIENTIFIC AMERICAN:

In an article entitled "Some Problems of High Voltage Transmission," which appeared in the proceedings of the American Institute of Electrical Engineers for March, 1912, Dr. Charles P. Steinmetz states:

"With a number of equal insulating disks sharing the voltage between line and ground, the potential difference across the insulators nearest the line is higher, and the potential difference across the insulators nearest the ground is lower, than the average potential difference per insulator, the more so the greater the number of insulator disks." Also, "From this it appears that the use of a large number of small insulator disks is uneconomical at very high voltages, and a few large disks of high disruptive strength are preferable." Also, "To extend the insulating possibilities of the suspension insulator type far beyond the voltages now contemplated, therefore, requires a *grading of the insulator disks in their capacity*, so that the disk nearest the line has the highest, that nearest the ground the lowest capacity, or the addition of capacity at the surface of the insulator disks, in proportion to their distance from the ground."

Illustrated herewith are two forms of high-tension insulators which have been patented by the writer. These were filed, respectively, on September 23d, 1907, and December 4th, 1909. They disclose that as early as 1907 the writer understood and appreciated the value of graded suspension insulators for high-tension current. It is now conceded by many of the



Types of graded suspension insulators.

foremost electrical engineers that insulation of the graded suspension type is the best practice, as it insures reliability and continuity of service, under the most adverse conditions, providing means at the same time for keeping the line in operative condition even though direct lightning strokes should reach it.

Brooklyn, N. Y. LOUIS STEINBERGER.

Notes for Inventors

Geographical Index for Clocks.—In patent No 1,034,496 Jean B. Olnger of Milwaukee, Wis., provides an attachment for clocks for showing upon an ordinary dial the hours for various principal points or countries all around the earth. The present invention is an improvement upon one shown in a former patent and includes a dial in the form of a star having twelve arms or rays. It is adapted to be attached to the hour-arbor and each of the arms carries at its extremity an index which guides the eye to the proper point of the clock-dial to give the time at the point to which the arm or ray is appropriated.

A Bottle That Has a Measuring Spout.—Meredith Clark of Garden City, New York, in patent No. 1,034,424, combines a measuring device with a bottle neck. It is in the form of a spout secured to the neck and the measure is so pivoted with relation to the spout that the bottle can be tilted in one direction to pour into the measure and in another direction to discharge the contents of the measure.

Patents for Treating Starch.—A series of patents, No. 1,035,829 to No. 1,035,842, have been issued to Alexander P Anderson of Chicago, Ill., relating particularly to the art of treating starch materials, starch, flour and flour products. Some of the patents relate to the making of starch pebbles, some to the art of puffing starch containing flour and some to the treatment of cereal grains.

A Filling for Vehicle Tires.—Rudolf Zimpel of Gross-Lichterfelde, near Berlin, Germany, has secured patent No. 1,036,170 for a mass for filling the tires of vehicles. The mass is composed of glue, linseed oil, shark oil and alum.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

FEED BOX.—A. W. WENDORF and O. F. SAMPE, Chili, Wis. This invention provides an inexpensive long lived box of plastic material, so constructed as to prevent wasting of feed while permitting the entire contents to be got at. Use of the rib will prevent wasting of the feed in the box by the stock, and the animals cannot throw or injure the box which is of plastic material.

Of General Interest.

NON-REFILLABLE BOTTLE.—L ARNAVAT, Tampa, Fla An object in this instance is to provide a device which will permit the liquid within the bottle to flow out whenever it is desired to use it, by the mere act of tipping the bottle, but which will prevent the introduction of a liquid from without

MOUTH GAG.—E T KREBS, P O Box, 378 Carson City, Nev. The object here is the provision of a device which may be easily inserted and removed, which will hold the mouth well open without causing pain or injury to the patient, and will leave the hands of the operator free, and which carries a tongue depressor and an illuminating means

DOWEL.—H HARKILD, 73 So Maple St., Spokane, Wash This invention is an improvement in dowel construction, having for its object to provide a novel construction whereby to avoid the necessity of mortising and tenoning in doors, sash or other wooden frames and to provide a novel construction for holding together any wooden joint

PROCESS OF MANUFACTURING SUBSTITUTES FOR OILS, CAOUTCHOUC, RESINS, AND THE LIKE.—L. LILIENFELD, Zeltgasse 1, Vienna, VIII, Austria. All products obtainable according to this invention may be used alone or mixed with other materials. The union of the products made with one or more other materials and softening agents may be effected by mixing or kneading without the use of any solvent, or the product dissolved and the solution mixed with other material in an undissolved or dissolved condition. The products are insoluble in water, but they may be incorporated with aqueous solutions of many binding agents This may be necessary for those binding agents which are not soluble in solvents that dissolve the products.

PROCESS FOR FINISHING, FILLING, LOADING, OR DRESSING TEXTILE FABRICS AND SPUN GOODS.—L. LILIENFELD, Zeltgasse 1, Vienna VIII, Austria For carrying this process into practice crude viscose or viscose purified according to one of the well-known processes, e g, those using salts, weak acids and salts, alcohols, weak acids and alcohols, other agents which withdraw water, bisulfite lye, sulfuric acid, carbonic acid and other weak acids and the like and possessing a certain percentage of alkali, is applied by hand or by means of suitable machines onto the fabric or spun goods to be finished or is incorporated therein

UMBRELLA HANDLE.—G. TESTA, care of G Linde, 23 John St., New York, N Y. This invention provides a handle movable on the cane of the umbrella to form a tip retainer for the folded ribs, provides a means for maintaining the handle in adjusted position on the umbrella cane; and provides an attachment for umbrella handles to adapt the same for transfer from one handle or umbrella cane to another.

COMBINED CALK PLATES AND CARRIER.—G. S MEYER, Newburgh, N Y This invention relates to attachable calks and means for attaching the same to an ordinary horseshoe. It is an improvement on the device forming the subject of a previous patent granted to Mr Meyer The present invention provides means to resist the tendency of the calk plates and their carrying frames to bend and turn sidewise under strain of service.

DENTAL APPARATUS.—F. E BUCK, Forsyth and Main Sts., Jacksonville, Fla The object here is to provide an easily operated device, wherein a holder is provided having a perforated bottom, and mounted to permit a maximum adjustment, both laterally, angularly and vertically, and wherein any adjustment may be made with one hand, and with a single handle.

CONCRETE MOLD.—C. H. F. DYHRKOPP, 545 Miller Ave., Spencer, Iowa. This invention provides a mold having upright posts for supporting the mold boards, secured together by ties which are tapering, so that they can be readily knocked out without disturbing the material of which the wall is formed, and further, so that they can be replaced in the openings thus formed readily without jamming.

CHAIN LINK.—W. D. TUSTEN, 757 Macon St., Brooklyn, N. Y. This improved chain comprises a number of links made in sections movable with respect to each other to permit the chain to be distended whenever desired; as, for instance, to permit the length of the chain to be increased when it is to be used in the form of a bracelet or armlet, so as to enable it to be slipped over the hand into position.

COATED METAL WIRE RUBBER FABRIC.—R M. BISSELL, care of Mrs R M Bissell, Valcour, N Y Among the principal objects which the present invention has in view are to provide an air and waterproof fabric having a reinforcing metal structure, and to provide in a fabric of the character mentioned a metal puncture resisting surface.

Hardware and Tools.

TRUNK LOCK.—J BREWER, 220 E 80th St., Manhattan, N Y, N. Y Mr Brewer's invention has reference to trunk locks and parts associated therewith, his more particular purpose being to provide a cheap, simple, and efficient mechanism for preventing easy access to the interior of the trunk, or the like It may be employed to secure the lid of any box or receptacle or even upon doors if need be

SCREW DRIVER.—F A TIBBALS, 1026 Main St Monmouth, Ill This invention is an improvement in that class of ratchet screw drivers which are provided with a lever attachment adapting them for very heavy work and for use in angles or places where it is difficult to operate an ordinary screw driver

ALINING PLATE FOR FLOOR HINGES.—O KATZENBERGER, care of Lawson Mfg Co, 215 W Huron St, Chicago, Ill The aim here is to secure registry between the free vertical edge of the door and the central portion of the door jamb when the door is in closed position, without depending on the screws in the floor plate for the proper adjustment

COMBINED LEVEL PLUMB, AND GRADE FINDER.—D W L FRANK, SR, 2024 W Harrison St., Chicago, Ill An object here is to provide a device which will combine in one instrument several different instruments for use in finding levels, grades, directions, etc Means provide for finding grades or determining the angles of slopes, by use of an "inclinometer" in connection with the level, compass, etc, and for protecting levels from dust and injury, and at the same time for magnifying these spirit levels

CORKSCREW.—E EARLE, care of Earle Bros, Townville, S C. In this case the object is to provide a simple and easily operated device especially designed to prevent the screw from slipping or pulling out of the cork, or the pulling off of the top of the cork, leaving the inner end of the cork in the bottle

PIPE WRENCH.—W L BESSOLO care of G Galagher, Los Angeles, Cal The handle proper is hinged to the shank of the fixed jaw, a ratchet device being applied at the joint to operatively connect the handle and movable jaw and cause the jaws to open more widely or grip an object more firmly according as the handle is pushed or pulled in one direction or the other In this case the invention is embodied in the construction and combination of a ratchet and pawl operative by connecting the handle and movable jaw

HOSE CLAMP.—A L P PERRY, P O Box 175, Roanoke, Va This clamp has a practically uniform bearing surface around the entire hose The device is devoid of any cutting edges such as tongues, or the like which are apt to injure the hose and cause it to wear out sooner than it otherwise would

Machines and Mechanical Devices.

HOTEL REGISTER.—J W THOMPSON, Portland Ore In this instance use is made of a casing having a display opening for the passage of the web passing over a bed plate and winding on rollers arranged within the casing, a motor located in the casing, and a specially constructed gearing driven by the said motor and adapted to be moved into driving engagement with either roller, to impart a traveling motion to the web in either direction.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each Please state the name of the patentee, title of the invention, and date of this paper

A 10,000-ton Motor-driven Ship

(Concluded from page 260.)

that with revolutions of from 140 to 145, there was a gain of only three revolutions while the propellers were out of the water.

The ship carries 1,000 tons of oil in her double bottom. She left Hamburg with a supply of 470 tons and reached Havana with 290 tons, having run at full speed with a fuel consumption of about 10 tons per day. The engines, being new, were run at only 135 revolutions per minute for the first few days; later this was raised to 142 revolutions. The best day's run was 329 miles, at an average of 13.3 knots per hour. It is expected that when the engines are shaken down the ship will be good for an average speed of 13 knots.

The fuel consumption for the main engines and all auxiliaries worked out at 0.34 pound per indicated horse-power per hour. Outside of this economy in fuel consumption, the adoption of the oil motor for transatlantic ships such as this presents many and great advantages. In the first place, in a ship of this size, 1,000 tons additional of freight can be carried, due to the fact that the space that would have been given up to the boiler plant is now available for cargo. Secondly, there is a reduction of fifteen men in the crew, namely, six stokers, six trimmers and three oilers. The present engine room force consists of seven engineers, one storekeeper and one electrical engineer. The engines ran throughout the trip to Havana with great regularity and without a single stop during the whole seventeen days consumed on the voyage.

An estimate of the economy in this ship over one driven by steam engines, shows that in one hundred days of operation there would be a saving of about $13,000, or say, about $50,000 in a single year.

A New Principal Examiner

HARRY C. ARMSTRONG, until recently first assistant examiner in Division Three of the United States Patent Office, has been appointed primary examiner in charge of Division Eleven, the vacancy thus filled having been created by the recent death of Edward H Eakle, former principal examiner.

Mr. Armstrong was born in Indianapolis, but removed with his parents at the age of twelve to Massachusetts, attending the excellent schools of that State, and completing his studies at the Worcester Polytechnic Institute.

After a useful experience in the works of the Washburn & Moen Co., Worcester, and the Thomson-Houston Electric Company at Lynn, he was appointed an assistant examiner in the Patent Office in the summer of 1894, and has passed through the various grades to his present high position

Mr. Armstrong, on entering the Patent Office in 1894, was assigned to the class of metallurgy, and has remained in the division, having charge of such subject throughout his entire eighteen years of service, having during such period an opportunity of observing many of the remarkable advances made in the steel and allied arts during the time mentioned. The metallurgical art, concerning itself mostly with the production of iron and steel in all its untold ramifications, it is needless to say, calls in its examination for more than ordinary skill, knowledge and judgment. How well Mr. Armstrong has acquitted himself, in charge of important subject, can be estimated by the high regard in which his abilities are held by his co-workers, superiors and the attorneys having dealings with him.

On two occasions Mr. Armstrong has been assigned by the Commissioner of Patents to important missions, representing the Bureau at the Patent Office exhibits displayed in the Seattle and Jamestown Expositions.

The new duties Mr. Armstrong is called upon to perform bring him into contact with the perplexities with our intricate shoe machinery as well as the manufacture of harness and other leather articles and boots and shoes *per se* and open up a large and interesting field of labor.

INQUIRY COLUMN

Inquiry No. 9280. Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears

Inquiry No. 9281. Wanted to buy machinery for bleaching walnuts and ivory nuts.

Inquiry No. 9282. Wanted name and address of manufacturer of coin-controlled gasoline-dispensing tanks for automobile use.

Inquiry No 9283. Wanted name and address of dealers in powdered Cocoa and Kola nuts in bulk.

Inquiry No 9284. Wanted a plan for washing, screening and loading gravel for concrete purposes.

Inquiry No 9285. Wanted factory, store, shop or bank articles to sell by canvassing at a profit of from $1.00 to $5 00

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Saving Three Thousand a Year in Ferry Tolls

SERVICE, better service than can otherwise be secured, is the keynote of the motor truck's widespread success. In most cases where they are used, however, they show more or less economy over horses which formerly did their work. In some instances this economy is secured in novel ways, and the following is a good example.

A Jersey City milk company has to haul a large quantity of milk every night to a point in the interior of Staten Island. A motor truck is now used, and it makes two trips each night, carrying on each trip one hundred forty-quart cans, each weighing 110 pounds. The present route covers a run of eight miles from the distributing station in Jersey City to the Bergen Point ferry, and a run of two miles after reaching Staten Island, making a round trip of twenty miles, or forty miles for the night's work. The ferry tolls are thirty-five cents for each passage, or a dollar and forty cents per night.

It was impossible for the horse teams which formerly did this work to take this route, because they could not cover the ten miles over steep grades fast enough to deliver the milk on time. Consequently, two teams were sent from the distributing station over the Erie Rail road ferry to New York, the toll being a half dollar for each team. From there it is a mile to South Ferry, and the toll on this ferry to Staten Island was seventy-five cents for each team. Thus the ferry tolls amounted to ten dollars a night, for two round trips for two teams, against a dollar forty for the motor truck. As this delivery has to be made every night in the year, the saving effected by the motor truck is $3,139 a year. As the motor truck displaces four horses, it undoubtedly effects an additional saving in this direction as well.

Motor Delivery of Furniture

A "SWINGING LOAD" of furniture, or one that projects beyond the tailboard of the van, will usually weigh anywhere from 2,000 to 2,500 pounds. We refer to new furniture and not the heterogeneous and solidly packed household effects to be found in the moving van. A load of 2,500 pounds can easily be managed by a team of horses on ordinary city streets, and, so far as load is concerned, there appears to be no advantage in substituting motor trucks for the horse-drawn vehicles; because the material is so bulky that the motor van cannot be more heavily loaded than the horse van.

In the delivery of furniture most of the time consumed is not in travel upon the road, but in the packing of the furniture to the best advantage and so that it will be readily accessible, and more particularly in the delivery of the furniture. Tedious waiting for the freight elevator seems to be the rule rather than the exception. At the height of the furniture season the moving man is constantly found in possession of the elevator. Thus, it is common to reckon the packing, transporting and delivering of a "swinging load" of furniture as a full day's work. A motor vehicle, because of its higher speed, could not possibly save enough time to permit of sending out two loads per day. However, when it comes to long distance delivery, the motor truck shows up to better advantage.

Owing to competition with department stores, a large furniture house in New York found it necessary to extend its free deliveries to a radius of about fifty miles from the city. This used to be done with teams, and any distance of more than twenty miles was considered a two-day trip and called for the board and lodging of the teamster and his helper and the horses at some inn over night. Last spring two first-class gasoline trucks were purchased for the suburban deliveries. Since then the company has been carefully weighing the relative efficiency of motor and team delivery. While the statistics are not yet complete, the motor vehicle has undoubtedly shown its superiority to the horse-drawn van. With the motor truck round trips of 65 to over 100 miles per day are easily taken care of. The record of one of the motor trucks for the month of August was 1,103 miles for twenty trips, some of which were as much as 105 miles long. The total number of stops for the month was 166, and the average running time for the entire period, 8.8 miles per hour. A single motor truck did more than twice the work of a horse-drawn van, and the over-night expenses out of town were saved.

To drive the motor truck, an experienced chauffeur at $20 a week was required as against $15 per week for the ordinary teamster. The driver of a van is usually accompanied by a helper receiving $12 a week, whereas an experienced teamster is required on the motor truck to assist in packing, routing and delivering the goods. Thus, the expense for labor in connection with the motor truck is $35 per week as against $27 for the horse-drawn van. This extra expense, however, has been outweighed completely by the excellent work of the motor truck. It is a decided advantage to have the entire delivery completed in a single day so that the men and machine are always housed at home. Quite aside from the saving in cost there are other important considerations that must enter into the reckoning. A motor truck always looks better, gives a better impression, and is liked better by the customer than a horse-drawn van.

The company has come out unqualifiedly in favor of the motor for long hauls, but still prefers to use the horse for city delivery. However, it has made no experiments so far with electric trucks which have proved highly efficient for city deliveries in many and varied lines of business.

Light Trucks With Pneumatic Tires v. Heavier Vehicles With Solid Tires

By G. H. Bryant

THOSE manufacturers of commercial motor vehicles who have stuck to the light-weight truck with pneumatic tires present some very strong arguments in defence of their production. It is claimed that a light truck is much more efficient in every way than a heavier truck, which, in most cases, uses solid tires, while the lighter vehicle can easily use pneumatic tires.

An interesting test was made during the past year by the Fuhrmann-Schmidt Brewing Company of Shamokin, Pa. The test was made with a light one-ton truck equipped with pneumatic tires and a seven-ton truck with solid tires. The trucks were pitted against each other for one day's work. The one-ton truck loaded, hauled and unloaded fourteen loads of beer of fourteen half-barrels each trip, or a total of ninety-eight whole barrels. The seven-ton truck hauled, in three trips, ninety-nine barrels, carrying but one more barrel than the lighter truck. The one-ton truck was managed by one man, who both loaded and unloaded it. The seven-ton truck needed three men to manage it. The expense of the running of the one-ton truck and one man's time was considerably less than that of the seven-ton truck with three men's salaries to be paid.

Satisfactory tire service with an auto-

mobile is merely a matter of proper construction and proper tire size. Hudson Maxim, the noted inventor, says, "If the load on pneumatic tires never exceeds the elastic limit of the rubber it will endure a very long time, whereas if loaded but slightly beyond the elastic limit, they soon go to pieces."

In overcoming tire troubles three things have to be considered: weight of the car, the size of the tires and the riding ease. The makers of the light trucks using pneumatic tires have in every way made light weight the strong point of their construction, using full-elliptic springs and a flexible frame to aid the tires in absorbing road shocks. On a car with a rigid frame and stiff springs all the cushioning of the road shocks must be borne by the tires. Consequently, the rubber and fabric are unduly strained and break down before their time.

That light weight has a marked influence in prolonging the life of the tire equipment is supported by results of careful experiments made by Michelin, the noted tire manufacturer. These experiments have proved conclusively that every five per cent increase in the weight of an automobile adds fifteen per cent to the wear on the tires Hudson Maxim declares that every twenty-five per cent decrease in the weight of an automobile means one hundred per cent added tire service.

Pneumatic tires and resilient shock-absorbing construction overcome the destructive action of driving over rough streets and permit a good average speed which is necessary in efficient truck service Not only do they save on the repairs of the car, but they take better care of the load carried, not causing it to endure a perpetual succession of severe road shocks. Pneumatic tires make the truck ride more easily, and it does not soon become a rattling old vehicle like many of the old-time horse trucks.

Subsidized Motor Trucks

By John R. Eustis

FRANCE was the first nation to recognize the motor truck for army transport service and has developed a subsidy plan which has been largely followed by the other governments. Under this plan the French government has now at its command in case of war upward of 2,000 motor trucks, or the equivalent of at least 12,000 horses or mules. These motor trucks are regularly engaged in private service, and the owners receive from the government for each vehicle six hundred dollars at the time of purchase and two hundred dollars for each of the three following years, a total of twelve hundred dollars. In return the owner agrees to keep the truck in good running order and to turn it over to the government, with its driver, any time on demand.

Motor trucks eligible for this subsidy must, however, be adapted for army transport service There are held annually in France, under the direction of the War Department, trials in which all manufacturers of motor trucks are invited to participate.

Motor trucks which have qualified in these annual trials sell much more readily than those which fail or which did not participate. The manufacturers, therefore, spare no efforts to win, and the engineering and commissary departments of the French army do their best to make the requirements sufficiently severe to show up any and all weaknesses.

This year's trials have just ended. Sixty-two trucks participated, representing thirty-two distinct models, made by sixteen different manufacturers. They were under military supervision and observation for an entire month, during which they made twenty daily runs over routes radiating from Versailles, the total distance being 1,558 miles for single trucks and 1,225 miles for trucks hauling a trailer. The runs had to be made under full load, both singly and in convoy formation, without load, and with gasoline, benzol and alcohol as fuels. An officer rode on each truck as observer, and a careful record kept of fuel and oil consumption,

as economy of operation played a part in the final award.

Following the road trials a careful examination was made of every part of each truck. One or more important units on each truck were dismounted, such as rear axles, jackshafts, gear boxes, road wheels, motors, and steering gears.

The French motor truck industry is greatly benefited by these annual trials. The army service requirements have tended to standardize wheels and tires, bodies and body fittings; under clearance and track; they have made radiator protectors an essential and hooks front and rear for hauling purposes; they have cut down fuel consumption and done a great deal toward developing accessibility.

One of the most important results of these requirements is the development of carburetors with which gasoline, benzol or alcohol can be used as fuel. It was not the price of gasoline, which is very high abroad, so much as the possible stoppage of the supply in case of war, that gave rise to this requirement.

In another particular, that of developing motor trucks which would run satisfactorily on steel tires, the French government has not been successful. At first only steel shod trucks were allowed to qualify for the subsidy, and now their use is encouraged by making wear and tear on tires count heavily in figuring the cost of operating, thereby giving steel tires a big advantage over rubber tires. Despite this, steel tires were used less this year than in any previous trial, and not one of the trucks shod all around with steel was able to qualify. A number used rubber tires in front and steel on the rear, and some of these qualified.

Outside of the purchase of a few score vehicles, most of which are used in the Philippines, the hiring of a few at different times in the past two years for use at various maneuvers, the promotion of two short tests and requesting manufacturers to furnish the names and addresses of all purchasers, our own Government has as yet done nothing toward utilizing motor trucks in army transport service. There are, however, more motor trucks in this country than in any two foreign countries combined; and in case of war our Government could purchase all it needed at a high price.

Discovery of a New People

(Concluded from page 261.)

Cape Bexley a recently abandoned village of forty snow houses was discovered on May 12th, 1910, with sled trails leading northward to Victoria Land. One hour later—in the middle of the frozen Dolphin and Union Strait—a man was discerned. He was sealing. Stefansson sent his Eskimo companion to interrogate him. The sealer drew his knife and awaited the attack of the emissary. After fifteen minutes of excited parleying in different dialects—for the sealer and the emissary spoke widely different dialects of the same tongue—peace was established. Stefansson then drew near. He speaks Eskimo himself; for the modern ethnologist is thoroughly acquainted with the dialects of the people whose customs and folklore he studies. Stefansson was the first white man the sealer had ever seen. Yet he was quite unmoved; he promptly concluded that the explorer was an Eskimo too.

The sealer turned out to be one of a small tribe numbering all told thirty-nine and calling themselves A-kū-li-a-kat-tág-mi-ūt. Unlike the half civilized Eskimos with whom explorers have hitherto come in contact the Akuliakattamiut were honest and kindly. Indeed Stefansson's account of their traits bears but the general theory that the savage, uncontaminated by civilization is far more tractable, far more hospitable, far more considerate than his more sophisticated cousin who has come into contact with the trading station. No member of the Akuliakattagmiut showed any disposition to pry into Stefansson's baggage; no one burst into his hut unannounced; and so far from denying him food, the tribe even supplied him and his men with choice parts of freshly killed seals and huge musk-ox

horn flagons filled with steaming seal-blood soup, although their own dogs had no more than half-rations of meat.

People Who Had Never Seen a White Man.

Like the sealer on the ice in Dolphin and Union Strait, the tribe had never seen a white man, or an Indian, or even an Eskimo from the west. They had heard of other people to the west; but so vague were their ideas of what those people were that Stefansson and his Alaskan Eskimo were taken for brothers.

The discovery of a tribe, completely isolated from all civilizing influences, preserving unchanged customs and traditions that are perhaps centuries old, is an event the scientific importance of which can be gaged only by an ethnologist. Perhaps the lay reader can grasp the significance of the discovery if he considers that when studying the habits of an uncontaminated people it is often possible to determine accurately at what period more civilized tribes first adopted implements such as metal knives, at what period they first began to weave baskets and make fish-nets, and at what period the first signs of culture began to appear among them. Sometimes the region from which a tribe originally emigrated can be deduced.

Important as the discovery of a people who had never been influenced by white men unquestionably is, Stefansson made another discovery, which is of more popular interest. Shortly after finding the Akuliakattagamiut, Stefansson discovered on Victoria Land, north of Cape Bexley, Eskimos who seemed strangely like northern Europeans. They called themselves the Ha-nē-rāg-mi-ūt. Their total number is forty, of whom Stefansson saw seventeen. How different they were from the usual aborigines of the North may be inferred from the fact that Stefansson's Alaskan Eskimo, who had worked for years on a whaler, said: "They are not Eskimo; they are fo'c'sle men." "Two of them," says Mr. Stefansson, "had full chin beards to be described as light, tending to red, every one had light eyebrows; one—perhaps the darkest of all—had hair that curled slight. A few had typically European blue eyes."

The Possible European Origin of a Strange People.

What is the origin of these Scandinavian-like people? Here is a splendid opportunity for the student of heredity who accepts the modern Mendelian views. Are these people simply sports or mutations, as the modern biologist classes anomalies such as albinos? Or are they simply the result of an intermingling of north European stock with Eskimo stock? Here is a biological question of the utmost importance, a question that can be answered only after careful study of the physical characteristics of the tribe has been made, both from the anthropological as well as from the Mendelian standpoint.

Assuming that the Ha-ne-rag-mi-ut of Victoria Land are mutants, a study of the people from the Mendelian standpoint might reveal that the earlier, purer type was even more European than its descendants. Again, it might turn out that there was a direct admixture of European blood. Although it is much too soon to venture any hypothesis, and although Mr. Stefansson has arrived at no definite conclusions as yet, it is a matter of much interest to ascertain what are the possibilities of a direct mixture of European blood.

In the fifteenth century the entire Norse-Teutonic colony of Greenland, with whom the name of Lief Ericson is historically associated, disappeared. The colony's importance may be judged from the fact that it had a bishop of the Church of Rome, two monasteries, a convent, fourteen churches, and over three thousand inhabitants. They were a seafaring people, who had crossed the water to Norway and to America before Columbus had set out to discover Cathay. Documents in the Vatican show that the colony was in a prosperous condition as late as 1412. Yet, in the seventeenth century Hans Egede found only Eskimo in Green-

The Panama Canal

The time is drawing nigh when the Panama Canal will cease to be a vision and will become a reality. No engineering work in the entire history of the world is of greater magnitude. For decades statesmen and engineers have urged the digging of a waterway which would unite the Pacific with the Atlantic.

The Panama Canal is a monument to American engineering genius. To describe it adequately the SCIENTIFIC AMERICAN will devote to it the issue of November 9th—the November mid-month number. How the great locks were constructed in which ocean-going steamers will swim, how a mountain was cut in two to make way for the Canal, how great steam shovels that scoop up five tons of dirt at a time dug out the bed of the waterway, and how landslides—avalanches containing millions of cubic yards—were coped with, all this will be told. Our editor, Mr. J. Bernard Walker, made a special trip to Panama in order to gather much of the material which will appear in this number. He spent several weeks at the Isthmus, studied every square inch of the ground, spoke with the men who are doing the great work—Col. Goethals, Col. Gorgas, and the rest—and brought with him facts which have not yet found their way into print, and which will first appear in the SCIENTIFIC AMERICAN.

The Grand Central Terminal

There will soon be opened in the city of New York, a gateway that leads into the heart of the western world's greatest city, a gateway that symbolizes the peace-making work of the engineer and the changes that he has wrought on civilization. The portal of a medieval city was an opening in a battlemented wall. Through it no man dared go unchallenged. The new gateway of New York is a different structure. Far more imposing, far more monumental than any gateway of old, the Grand Central Station will welcome tens of thousands, who will pass through its marble halls with no one to ask them whence they came or whither they go.

That beautiful structure may be regarded in two ways—as a symbol of civilization's progress and as an engineering work. To Mr. Jules Guerin, one of the most distinguished artists of our time, has been intrusted the task of presenting the symbol. He has made for the SCIENTIFIC AMERICAN two masterpieces—one of them a colored cover, in which the station is shown looming up mysteriously in the night, illuminated from within by its own myriad lights and from without by the welcoming lights of the metropolis. He has also prepared a double page drawing of the "Terminal City"—a drawing in which the brush and pencil have explained better than mere words can explain it, the symbolic meaning of this vast structure of marble and steel, clustered about with buildings that may be regarded as appurtenant to it—post offices, hotels, and apartment houses.

The engineering side will be treated in the usual SCIENTIFIC AMERICAN way. Fascinating, indeed, will be the story of the work. Few realize that in the Main Station alone there are approximately 28,030 tons of steel; that the total excavation amounted to 3,094,750 cubic yards; that there had been removed up to May 1st, 1912, 208,925 carloads, which would make a train reaching from New York city to Omaha; and that to blast out the 2,000,000 tons of rock, 730,000 pounds of dynamite have been used. Then, too, there is the story of the tracks, how they are connected with the subway, how they have been laid underground tier on tier, and how the whole station has been planned so that it would be not an eyesore, but an architectural adornment to a great city.

land and no trace of the Scandinavian blood or language. What became of the colony? Was it massacred by Eskimos? Was it swept out of existence by famine or pestilence? Or did it emigrate in a body?

"The folklore collected by Knud Rasmussen in Smith Sound, by Prof. Boas in Baffin Land and the Hudson Bay Region, and the sum of the evidence secured by our expeditions," says Mr. Stefansson, "seem to me to point strongly to the probability that the Norse colony in Greenland was never entirely exterminated, but that the larger portion of it escaped, and it is their descendants, mixed with the descendants of the Eskimos of their time, whom we now find in Victoria Land. We realize fully that there are several theories that might explain the presence of blonde Eskimos; we merely consider that this is the most probable one."

In support of a possible Scandinavian ancestry, Mr. Stefansson points out that there are slight resemblances between the language of the blonde Victoria Land Eskimo of to-day and the old Norse language. Then, too, the Victoria Land Eskimo sings at least one song, alliterated in the old Norse scaldic style—something unheard of among other Eskimos. The literary resemblances between the modern Victoria Land Eskimo and the old Norsemen are, however, not conclusive enough to point unmistakably to a Scandinavian origin for the tribe. But taken together with the physical characteristics of the tribe, which will soon be studied on the basis of the measurements and photographs that Mr. Stefansson has taken, it is possible that a chain of evidence will be forged, so strong, that what is now tentatively offered only as a mere theory may become an established ethnological fact.

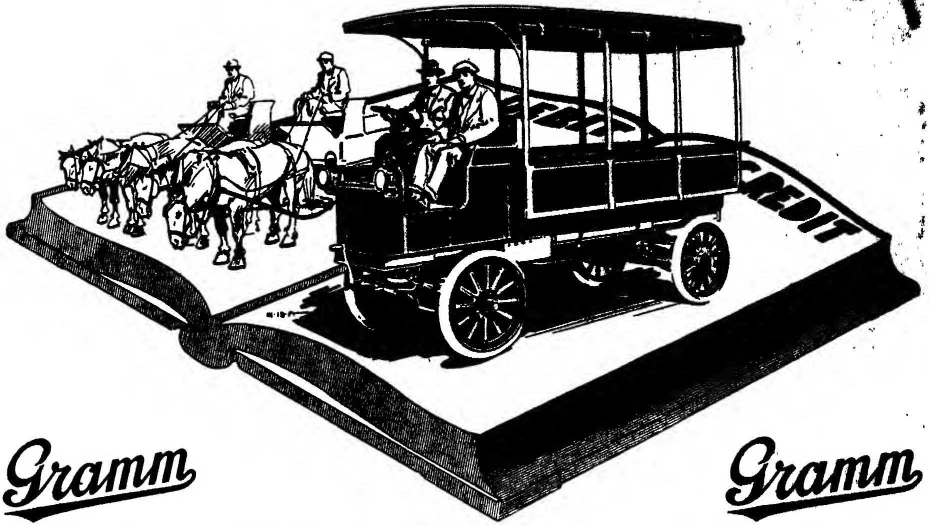
In the opinion of Dr. Clark Wissler, curator of the department of anthropology of the American Museum of Natural History, Mr. Stefansson has returned to the United States with an amount of material for study that is unusually rich and promising. Mr. Stefansson hopes to prove after he has had an opportunity of studying a large collection of ethnologic material that represents the life, customs, folklore not only of the hitherto unknown Eskimos of Victorial Land, but of the known tribes that inhabit the region about Point Barrow and the northeastern shore of Alaska, that the Eskimos as a whole came from the east along the north shore of the American continent to Alaska. It may turn out that the Eskimo traditions in regard to certain important events, such as the chronological sequence of the founding and abandoning of villages can be relied on for longer periods than ethnologists have hitherto assumed. Thus, it may become possible for Mr. Stefansson to show with sufficient accuracy just when Eskimos first reached the mouth of the Yukon River or whatever point it was that brought them in contact with people of another race.

So, too, the archeological relics that Mr. Stefansson has brought back may show that such arts as pottery-making and basket-weaving are far more ancient in Eskimo culture than anthropologists have supposed. It seems reasonably certain at present that Mr. Stefansson's archeological work extends the known area of the use of pottery over a thousand miles east of Point Barrow, which was by many considered the eastern limit of the knowledge of the art.

The expedition has brought back specimens of what may prove to be rich iron ore from Victoria Land, north of Cape Bexley. Copper is picked up almost anywhere by the natives of the whole Coronation Gulf district, each family having its favorite place to search for knife and arrow material.

A Jubilee of the Umbrella

ON August 12th it was 200 years ago that Jonas Hanway of London was born, who is credited with being the first person to use an umbrella. When first carried, the latter consisted of whalebone, covered with heavy silkskin, the whole weighing nearly 10 pounds.


CREDIT

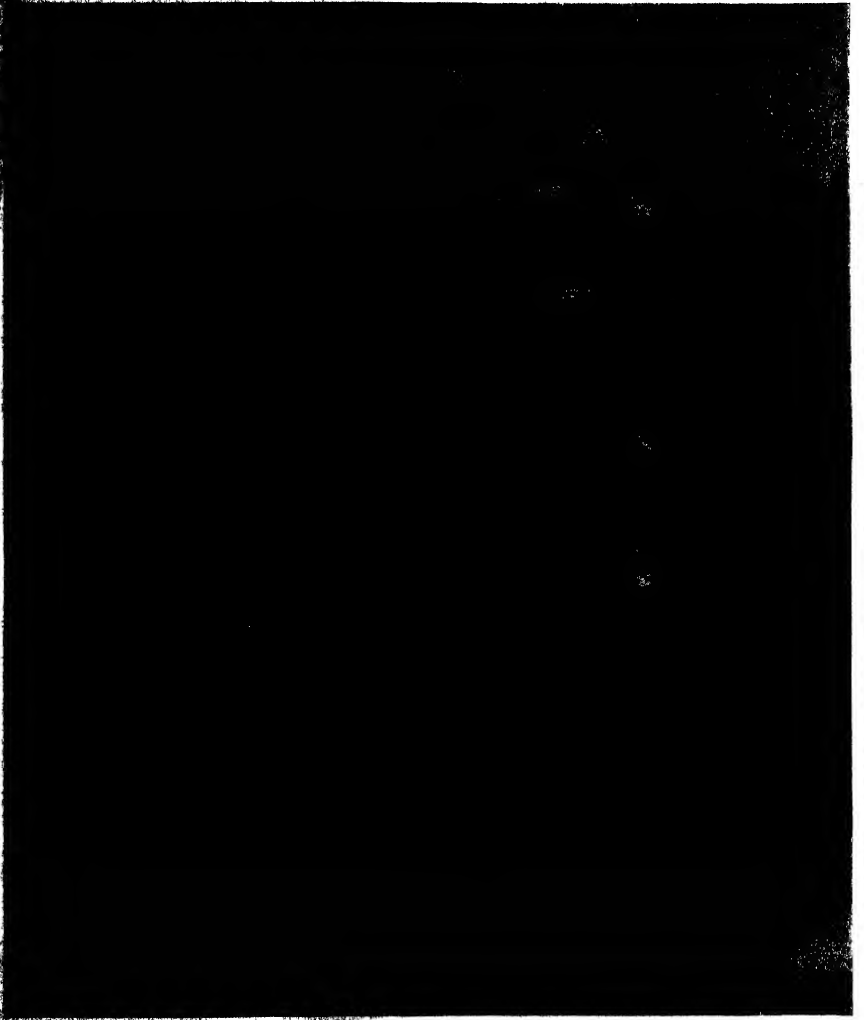
SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, OCTOBER 5 1912

[10 CENTS A COPY
$3.00 A YEAR



The great hydro-electric plant at [illegible], Norway, of 250,000 maximum horse-power, is made up of 15,000 horse-power units, each consisting of two Pelton wheels and twin generators mounted on a common shaft

A 7,500 HORSE-POWER PELTON WATERWHEEL. [See page 278.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, OCTOBER 5, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions
Mexico, Cuba, and Panama
Subscriptions for Foreign Countries one year, postage prepaid. 4.50
Subscriptions for Canada, one year, postage prepaid, ... 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . per year, $3.00
Scientific American Supplement (established 1876) . " 5.00
American Homes and Gardens . . . . " 3.00
The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Good Crops and Good Times

AMONG the many prophets who have lately been predicting a return of business prosperity there is one whose voice speaks with special authority. We refer to the Agricultural Department at Washington, whose recent announcement that the crops throughout the United States promise to be of unusual abundance will do more to stimulate confidence in the business world than any official announcement that has emanated from Washington for many months past. Not that the Agricultural Department has made any definite prediction of a revival of business, for that does not come within its province; but it is so generally understood nowadays that thriving agriculture is the basis of general business prosperity, that the announcement of a "bumper" crop has come to be taken as equivalent to a prediction of a prosperous year.

The estimate of the probable crop for this year presents an imposing and encouraging array of figures. The wheat crop, which is estimated at over 700,000,000 bushels, should bring to the farmer over $600,000,000. The corn crop, which is estimated at nearly 3,000,000,000 bushels, has a farm value estimated at $1,350,000,000; while the value of the oats crop, which will reach the highest figure in the history of our country, or 1,200,000,000 bushels, is not far short of $400,000,000. Adding to this the value of the crop of rye and barley and the other multitudinous farm products, it is estimated that the value of the products of our farms at present prices will be over $7,000,000,000. Not only does this vast sum benefit the farmer by swelling his bank account or by enabling him to lift his burden of mortgage, but the moving and disposal of the crop will bring proportionate wealth in other directions; to the railroads for transportation, and to the steamship companies for carrying the surplus abroad; to the owners of the elevators, a vast industry in itself; to the owners of the huge mills that turn it into flour, and to the buyers and brokers who bring producer and consumer together.

Nor does the stimulus of plentiful crops end with the mere matter of their sale and distribution. The farmer himself becomes a large purchaser of agricultural machinery, and the general improvement of his farm by the construction of new buildings, the construction or renewal of fences, to say nothing of the purchase of automobiles and additional luxuries for his home, not only directly stimulates business in a wide variety of trades, but, indirectly, reacts strongly in stimulating that revival of credit and confidence which is essential to any lasting prosperity.

Theory Modified by Practice

AS the result of his experiments with the whirling table, Langley demonstrated that the forward portion of the wings of an aeroplane is more efficient than the after portion, and he showed that, other things being equal, the greater the length of the leading or entering edge in proportion to the area of a plane, the greater would be the efficiency. In other words, a long and narrow plane would be more efficient than one that was short and deep. Basing their conclusions upon this theory, many writers predicted that, as speed increased, the planes would approach in their proportions the long and narrow wings of fast-flying birds such as the albatross.

As a matter of fact, the progress of the last few years in racing machines has shown a tendency to shorten the length and deepen the width of the plane, a tendency which was particularly noticeable in the remarkable machine with which Vedrines won the cup at Chicago. The reason for this departure from theory is that for structural reasons the shorter and deeper wing is found to be preferable. For a given area and weight, the more compact the machine, the stronger it will be. Bending stresses, tending to break the wings are less, and the head resistance also is reduced—the guy wires being shorter and the whole system of trussing presenting less area and head resistance. Langley's law still stands; and the proportions of the racing monoplane of to-day simply prove once more that theory is ever greatly modified by practice.

Again the Question of Pier Extension

LAST year it was the White Star Line and this year it is the Hamburg-American Line that is petitioning the War Department for a permit to add one hundred feet to its piers at the port of New York, in order to accommodate its latest and largest passenger ship. The "Imperator," which was supposed to be 900 feet, and we are now informed by the Vice Director of the company is 919 feet in length over all, is due at this port next spring. The longest pier of the Hoboken docks of this company is 850 feet in length or seventy to eighty feet less than is necessary to give accommodation with proper clearances, for the new liner. When the White Star Line had its hearing before the War Department it was urged in reply that the granting of the permit for a 100-foot addition would not by any means settle the question of encroachment upon the North River fairway; since even larger ships would probably be built in the future. The predicted increase has occurred, and once more the Board of Engineers of the United States Army are confronted with the problem of reconciling the apparently conflicting interests of the owners of these big ships and of the owners of the lesser craft which make use of the Hudson River.

The Board of Engineers, whose duty it is to protect the rivers and harbors of the United States against encroachment by private interests, have always shown a commendable zeal in the fulfillment of this trust. To say that at times they have erred on the side of caution and have been perhaps a little too reactionary, is distinctly to their credit; for the State and Federal interest in the preservation of our rivers and harbors is both large and permanent; and over and above that are those vast commercial interests, whose urgent demand that the harbors and waterways of the country be so safeguarded as to promote the greatest good of the greatest number cannot be gainsaid.

Now with regard to the particular case of the Hudson River, it will be agreed that if the proposed extension of piers into the fairway will impair its usefulness as a great artery for waterborne commerce, the lengthening of these piers, however greatly it may be demanded by the exigencies of any particular steamship company, should be strictly forbidden.

But will a moderate extension of the piers work any serious injury to the Hudson River? We very much doubt it. As a matter of fact, after over a year of service, the 100-foot extension of the White Star Line pier has failed to show that it has been detrimental to the river, either by causing swifter currents, or by acting as an obstruction to traffic up and down the Manhattan shore line. For this reason, among others, we believe that the extension of the Hoboken piers should be permitted, and this, not merely in the interest of the particular company now affected, but of shipping at large, and of the port of New York in particular.

In any discussion of this question there is one fact which must never be forgotten, namely, that there will be an inevitable growth in the size of future steamships. This increase is guaranteed by the fact that, other things being equal, it costs less to carry a ton of freight a given distance in the larger than it does in the smaller ships. Passengers, moreover, can be transported with greater comfort and with less distress from the motion of the sea. Ships will grow larger, not smaller; let us be sure of that; and if, because of the lack of accommodation, the large ships of the future cannot come to the port of New York, they will go to those harbors where they can be accommodated.

The question, then, narrows itself down to this: Are we willing to sacrifice a little of the width of the Hudson River at New York in order to maintain our position as the leading port of the Atlantic seaboard? The argument in favor of pier extension is strengthened by the fact that in comparison with the large ports of the world, New York, in respect of the width of its fairway, is the most favorably situated of all. Thus the clear width of the Thames at the London docks is 600 feet only; Hamburg and [illegible] about 1,200 feet; the Thames at Tilbury [illegible] only 1,600 feet; Antwerp, 2,000 feet; [illegible] docks of Liverpool have only from 2,000 [illegible] between opposite pierhead lines. As [illegible] this, the Hudson River at its narrowest [illegible] clear width of 2,650 feet; and even if the [illegible] feet be added to the Hoboken pier, there [illegible] clear width of 2,840 feet between the bulk[illegible]

The SCIENTIFIC AMERICAN would be the [illegible] cate such an encroachment upon the ri[illegible] be detrimental to traffic; but in view [illegible] relating to other great ports of the worl[illegible] the proper compromise between length [illegible] width region of river has yet to be reached. [illegible] the limit of pier length will be found to lie [illegible] and 1,050 feet, according to the location.

Pipe Galleries

IT is a strange anomaly that in this sci[illegible] and particularly in practical America, [illegible] tinual tearing up of streets to lay, repair [illegible] nect up pipes and wires, has not been sup[illegible] the practice of putting underground structu[illegible] galleries. The inconvenience of the constant [illegible] disturbance is apparent to every one, and the [illegible] ness of present methods has been forcibly po[illegible] again and again. Nevertheless, nothing su[illegible] has been accomplished in America in the way [illegible] ing municipal pipe galleries.

It is true that the frequency of street opening may have been reduced, and that public service corporations are not allowed to dig whenever they please, without the formality of even a permit. Moreover, before new pavements are now laid down, in many cities it is more often the custom to require corporations to do in advance any substantial construction or repairs which may be needed, in order to postpone as long as possible the first breaking up of the new pavement. And yet, sooner or later, the breaking up process begins again.

The most extensive placing of underground structures in galleries is, of course, to be found in Paris and London, the sewers being used in Paris, while in London the County Council has constructed pipe galleries under a number of new streets. The trouble in America has not been due to a lack of study of the subject; for the best-designed galleries actually planned anywhere appear to have been those proposed by the late Rapid Transit Commission for the subway in lower Broadway, New York. These galleries, it may be remembered, had seven separate divisions, with the electric ducts of the street railway company in the center, chambers for pipes on each side of the street, and separate ducts for high and low tension conductors, also on each side, with separate manholes for each class of wires, and distribution passages from manholes along in front of buildings. Long openings for handling pipes and ventilation were also provided, and it was a great setback to the progress of street engineering when the idea of building the galleries had to be abandoned. Various types of galleries, based on the New York type, were suggested for Boston, when the Washington Street subway was proposed, but nothing resulted beyond the plans.

The chief reason for the failure to build the lower Broadway galleries was said at the time to be a difference of opinion as to what city department was to have charge of the galleries, and unfortunately the completion of the subway could not be delayed for the settling of the question. In Boston there were several objectors. The municipal engineers consulted wanted their pipes above the subway, while the railway company objected to any construction which would lower the station platforms a foot more than was absolutely necessary. The city engineer, moreover, objected to any placing of pipes, water, sewer, or gas, in an open gallery, no matter how well designed, on the ground that the character of municipal employees had so deteriorated that it was unsafe to place the maintenance in their hands of pipes in a common gallery.

While it is well to err on the side of safety before making radical changes, there appears to be ample testimony that the placing of pipes in galleries would make for greater safety instead of greater danger. In the London galleries, large gas mains are found close to electric light cables, and yet no explosions have occurred; whereas gas mains buried under streets have caused constant explosions in different cities.

The first American city which will make a real beginning with pipe galleries, will be performing a great public service. A block or two would be better than nothing; but what is done should be well done or not at all. For a badly constructed or poorly maintained gallery might hurt the cause more than it helped. It is greatly to be hoped that the public service corporations will see the advantages of going into well-regulated municipal galleries, instead of burying their pipes and wires in the present haphazard fashion.

Electricity

[illegible]ing with Quartz Lamps.—To show by [illegible] poorly Chicago is lighted, a group of [illegible] has installed six quartz-tube mercury-[illegible] a block of Randolph Street, 320 feet [illegible]s are of 5,000 candle-power and burn [illegible] night at an annual cost of sixty-nine [illegible] foot.

[illegible]tric Car.—On the Enkoping-Hoby line of [illegible]ate railroad there is now running a new [illegible] engine and electric car which carries 40 [illegible] is claimed that the Diesel engine which [illegible] is very well adapted for this purpose and [illegible] benzol motor. This latter was tried by [illegible] but rejected. The railroad line is a short [illegible]iles, and a good speed of 45 miles an hour is [illegible]. As usual, the engine drives a dynamo so as to [illegible] for the car motors. The fuel consumption [illegible] of oil against 0.5 to 1 ton of coal for a steam [illegible], and a small amount of water is used. As [illegible] is consumed, but few stops need be made [illegible]water.

[illegible] With the Aid of Wireless Telegraphy.—[illegible] government is engaged upon plans for the [illegible] telegraphy in mapping colonial regions, [illegible] Belgian Congo. It is well known that a very [illegible] can thus be obtained for the difference in [illegible] between any two points as shown by the differ[illegible] their respective times. Previous experiments [illegible] this latter is readily shown by sending wireless [illegible] between the two points. The method is likely to [illegible] a valuable one in colonial regions where there are [illegible]h lines, as portable wireless posts can be set [illegible] little trouble. In Belgium it is thought that a [illegible] the Congo which would take ten years to draw up [illegible] be made in two years.

Wireless Telegraph Outfit for Aeroplanes.—The new Flanders army aeroplane is commencing to make flights in order to test the new wireless outfit that has been fitted upon it, and some good results are expected. The apparatus is of the latest Marconi construction and is made up into separately contained units so as to permit of distributing its weight, as may be found necessary. A special unspillable accumulator is employed. The only high-tension wire on the aeroplane is run in a well-insulated tube through the fuselage of the machine, so as to guard against shocks. The trail wire has a safety-breaking plug which releases the wire at once when pulled upon by any object on the ground. For the ground-receiving station an improved portable wireless post is used which can be erected in a few minutes.

Heating a Church With Electricity.—A successful instance of electric heating for a large church is seen in the St. Sebaldus Church at Nuremberg. Individual heaters are used in each pew so that a good distribution of heat results. This is done by mounting a long tube heater near the floor in front of the seat and along the back of the following pew, which acts as a foot warmer. The electric heating tube is a 3-inch iron pipe which contains a smaller tube wound with resistance wire. At each pew is a switch for cutting out the heater, and all the separate wires from the heaters run to connection boxes placed at different points under the floor. A perforated iron foot rest runs along above each heater. The church has a seating capacity of 1,200, and the length of pews is 1,750 feet in all.

Electric Cars for the Suburban System of Paris.—Preparatory to carrying out the project for using electric trains on the extensive west suburban system of Paris, the railroad company is testing a new passenger motor car which will probably be used. It is now running on the Paris-Versailles electric line. For the suburbs it is desired to adopt a system of frequent and short trains as in the subway, and these will be made up of trains of two or several motor cars and perhaps trailers. The new car has double trucks, each one fitted with a 250 horse-power motor, making 500 horse-power for the entire car. It makes 50 miles an hour on the level. Trains are made up with a motor car at each end and intermediate motor cars or trailers, using the multiple-unit control method. Such cars have seats for 100 passengers. At some hours a single car can be run, and at others 6 to 8 cars.

Wireless Telegraphy in Bolivia.—Bolivia is the latest of the South American republics to adopt wireless telegraphy, the government having entered into a contract with the British Marconi Company for laying out an extensive scheme. This provides for the erection of two groups of stations, namely, five stations of 5 kilowatt size and two 10-kilowatt plants. The latter will be erected at La Paz and Puerto Saurez, while the smaller plants are located at Riberalta, Cobija, Trinidad, Yacuiba and Santa Cruz. The progress of this work will be watched with interest, for the stations may ultimately become linked in a considerably larger network than is at present apparent. Bolivia, Chile and Argentina—at least three countries—will be in possession of important wireless organizations, so as to perfect the internal working and connect the three republics.

Aeronautics

The following unique advertisement appeared recently in a Hanover (Germany) paper: "Lost, from an aeroplane, gold watch and chain; was last seen disappearing in large stack of rye on a field near Ulzen. Liberal reward for return of same."

A Proposed Long-distance, Hydro-aeroplane Flight.—A Paris to the sea flight for hydro-aeroplanes is being discussed by the Aero Club for next year, and the prevailing idea is to make it a river and sea event, that is the flights will take place over the Seine from the city to the Channel coast at Deauville, the well-known watering place. Then the flyers will make over-sea races of various kinds in the Channel region. At Deauville it is greatly desired to promote an event of the kind, and a local committe is now formed, headed by Prince Murat and Senator Henri Deutsch.

An Aeroplane for Vertical Movement.—In a patent, No. 1,037,278, a St. Louis man, John R. Martin, presents an aeroplane in which a segmental rack is carried by the plane and a gear carried by the car suspended from the plane is meshed with the rack and the plane may be shifted from a vertical to a flying position. A propeller is carried by the plane and is suitably driven and means are provided for operating the steering device so that a single propeller may be employed to lift the entire machine from the ground in a vertical course to a flying position and may then propel the machine in flight.

Flying Boats on Lake Leman.—During the present season's tests a number of hydro-aeroplane flights are being made on Lake Leman. Recently the Swiss pilot, Grandjean, on a monoplane of his own design with a 50 horse-power Oerlikon motor, won the Eynard prize of $2,000 which was founded in 1909 under rules made by the Swiss Aviation Club. Grandjean made the flight over the lake from Chillon to Versoix, near Geneva, with stops according to the rules at Ouchy and two other places. He thus holds the prize, but this can be competed for up to December 21st of this year.

Hunting with Aeroplanes.—Hunting of game by aeroplane is likely to become one of the sports of the future, and in France several of the pilots are becoming adepts at this kind of chase. Moreau is one of these, but he lately met with an accident which however is not very serious. He had been invited by the Mayor of Varennes, near Paris, to take part in the opening of the fall hunting season, and was flying near the ground, when a shot fired by an imprudent hunter struck him in the eye. But he was soon able to make a landing and received medical aid at once, so that probably he will not be laid up for more than two weeks.

Long Distance Conduit Pipe for Hydrogen.—The newly opened airship harbor at Frankfort, Germany, has a long distance main for hydrogen, the first of its kind in Germany. The gas comes from the chemical factory "Elektron," of Griesheim, 2 4/5 miles away, where daily from 635,000 to 706,000 cubic feet of hydrogen are obtained as a by-product, which formerly was allowed to escape into the air. This quantity would be sufficient to fill completely one Zeppelin airship a day. At present the amount of gas that can be piped to the terminal at Frankfort is 35,000 cubic feet per day. On account of the easy diffusibility of hydrogen gas, nearly the entire length of the piping had to be welded together by the autogenous process. The gas is conveyed to a gas holder of about 212,000 cubic feet capacity, from where it is led through subterranean pipes to the cement flooring of the airship hall. These pipes terminate in 18 shafts from which connection can be made with the individual gas cells of the airship.

A Military Farman Biplane.—A very interesting test was made by Henry Farman with a new aeroplane, which is designed for army use, this being a miniature biplane having a total spread of 30 feet, but it can be folded up within 7 minutes, so as to have but 10 feet width. The body of the aeroplane can be taken apart and packed likewise. M. Farman set out to make a practical flight with the aeroplane in the neighborhood of Paris, and left the Chalons camp at 8 o'clock in the evening with the idea of alighting near the city and of proceeding with a rapid dismounting of the flyer, so as to transport it quickly by road. This he was able to do very well, and he alighted in a very rough plowed field in the suburbs. Aided only by a farmer, he rapidly dissassembled the machine and awaited an automobile, which then towed his dismounted biplane back to town at full speed so that it could be placed in an automobile garage. Thus it was shown that the Farman biplane can be handled very quickly in this way. On the flight it made an average speed of 75 miles an hour, and at the start it rose to a height of 300 feet in 50 seconds. This new biplane of Farman's is fitted with a 75 horse-power Gnome motor. On a previous test at Chalons, it carried on board 100 pounds of gasoline together with the pilot and one passenger and made 70 miles an hour. It could be packed up for transport in 7 minutes and 15 seconds.

Automobile

Early Self-starter.—That the self-starter is not new, is shown by the record of one American company manufacturing air-cooled cars. As long ago as 1902 a Syracuse man, John Wilkinson, owned a motor car, equipped with a motor starter of the compressed air type.

One Way to Stop the Cut-out Fiend.—Finding it next to impossible to prevent motorists from opening the muffler cut-out and emitting Gatling gun explosions, the Columbus (O.) City Council is considering a bill which would cause all muffler cut-outs to be sealed by a city official, for a fee of 50 cents. If at any time or place a car is found to have this seal broken or damaged, it means a fine—no further evidence being required.

Veracity and Value of Police Evidence.—A British lawyer whose client was arrested for speeding questioned the evidence given by the policeman, claiming that the man was incapable of judging speed or distance. He asked the officer the width of the courtroom, and received the answer "20 feet." The room was over 30 feet wide! The court subjected him to a test of time and the answers fell so far short of the correct, that the accused was let off free.

An Odd Engine Starter.—The problem of satisfactorily starting a gasoline engine has been attacked from a new point of view, the apparatus being somewhat similar to an old-style "priming attachment." Screwed into each valve cap is a small reservoir which contains gasoline. Into this gasoline dips an electric filament which receives its current from a battery, through a starting switch. When the current is switched on, the filament is heated and gasoline vapors are forced through a tube into the cylinders.

Reckless Use of Gasoline in Cleaning.—The acme of recklessness appears to have been reached by certain men in an Iowa public garage recently. Too lazy to use the more tedious method of washing oily articles with soap and water, they improvised a gasoline spray, with which they started cleaning grease-covered machinery. As might have been expected, the entire garage was soon converted into a giant carbureter, the mixture created by the gasoline vapors and the atmosphere within the building finally exploding with terrific force.

The Passing of the Horse in Cities.—Time was, and that not so very long ago, when the first thing the relatives of a sick person did was to cover the street in front of the house with straw so as to deaden all sounds from passing vehicles. The great number of rubber-tired automobiles has made this precaution unnecessary, and instead of the time-honored straw covering, there appeared a big sign at each street crossing near the "house of sickness," on which this sentence was painted in big letters: "Don't hoot! Illness!" Coincident with the appearance of this sign in Kensington, London, the London *Daily Mirror* published a trenchant editorial on the foolishness of taxing automobiles for the use of city streets. "The horse is a danger and a nuisance in the streets of a large city. We hear a lot of motor-car street taxes, but it is the horse which should be taxed, not the motor car. The horse is unhygienic, erratic and occupies too much space. Tax the horse as you would dogs, and leave the motor cars alone!"

A New Speed Indicator for Automobiles.—A new speedometer-tachometer of the hydraulic type has recently been introduced in this country from Germany, and while it is suitable alike to all manner of vehicles its chief interest naturally centers around its applicability to automobiles. It consists mainly of a three-cylindered pump, submerged in oil and actuated by a flexible shaft coupled to the front wheels. The rapidly revolving shaft causes the pump to force oil into a fourth cylinder, mounted alongside of the pump, in which a piston rises or falls according to the quantity of oil in the cylinder. At the bottom of this cylinder is a small orifice which permits the oil to return to the pump. The top of the piston is connected through a gear and lever system with a recording hand, and with a tape recorder on which all extraordinary motions of the piston and toothed disk recorder are printed together with the time of their occurrence. The recorder works in the following manner: As the speed of the front wheels increases or decreases, a valve covering the above-mentioned oil orifice is closed or opened more or less, thus permitting varying quantities of oil to escape and controlling the rising and falling of the piston. The smallest rise of the piston is greatly amplified by suitable gearing, so that the recording hand describes an arc of a circle sufficiently large to be easily recognizable. Interposed in this gearing and forming part of the transmitter is a disk fitted with a number of pins at certain intervals. When the piston rises the disk turns, and as soon as the speed exceeds a certain arbitrary limit, contact with the pin at that point causes the type recorder to act, and an imprint of the time and of the excessive speed is made. In addition to these ordinary performances the recording device can be arranged to record every movement of the steering wheel, the brakes, the clutch, etc., so that a complete record can be kept of the entire movements of the car and driver, which might prove of extreme importance in cases of accident.

The Vacuum Cleaner in Cotton Mills

Modern Methods Applied to Industrial Sanitation

IN the earlier days of the industry cotton spinning as an occupation was notorious for its pernicious effects upon the health of the workmen. The air in the shops was laden with fine dust of cotton fibers and other floating particles derived from the raw material and the surroundings, and this, being breathed in day after day by the workmen, gradually choked up the fine passages of the lungs and rendered the men an easy prey to the attacks of disease germs. Tuberculosis of the lungs was a typical occupational disease of cotton spinners. And, indeed, a look at the last of the illustrations accompanying this article shows clearly enough the danger lurking in the cotton mill dust. For in this microphotograph we clearly discern not only the cotton fibers—none too desirable intruders in human respiratory organs—but also various sharp and angular fragments, which, entering the lung, lacerate its delicate tissues and start local irritations and wounds, favorite points of attack for the tubercle bacillus.

A particularly harmful operation in the cotton mill is that of "stripping" the carding engine cylinder, which is performed three or four times daily on each machine. In this procedure a cloud of dust is raised, which diffuses itself through the work-room, unless precautionary measures are adopted. One of the first improvements introduced was to place ventilating fans at suitable points, which drew the air, and with it some of the dust, out of the room and discharged it out of doors. But evidently this is at best only a poor remedy for the condition combated. With the development of modern methods has come a new system which is a vast improvement: a suction conduit leading from a hood over the stripping machine to the exterior. The hood is placed close to the point at which the pernicious dust is raised, and, in fact, incloses the stripping brush, so that the removal of the floating particle is practically complete. The principle employed is essentially that of the vacuum carpet sweeper. The entire stripping brush is inclosed in a portable hood, connected to a vacuum exhaust tube.

At first sight it may appear that the addition of such a hood and conduit to the stripping brush would add not inconsiderably to the burden of the workmen who have to carry the brush from machine to machine. The old type of brush weighed from 48 to 56 pounds. As a matter of fact, by careful attention to the material employed (aluminum) it has been found possible to make an entire brush and hood with an aggregate weight not exceeding 60 pounds.

There are several types of vacuum strippers. In some the dust is collected in a canvas bag, while the fiber is "stripped" from the brush separately. In another form of machine both fiber and dust are sucked off together, and the dust is then separated out by filtration. An idea of the nature and quantity of the dust thus collected and the fiber recovered may be obtained from one of the accompanying illustrations, in which *A* shows a basket filled with the dust, and *B* the corresponding valuable fiber recovered.

A School for Traction Engineers

IN the February 10th issue of the SCIENTIFIC AMERICAN an article appeared entitled, "Making the Tractioneer." This article gave to the reader an idea as to what is being done in the line of education of operators of farm tractors.

Since the appearance of the article in question a new institution has been organized, which aims to specialize on this type of education. The institution is known as the Indiana School of Tractioneering, and is located at LaPorte, Indiana. The school aims to teach that phase of engineering which will be of the greatest value to the farmer. It will not only instruct the farmer in the operation of his gas engine, but will also instruct him in all those subjects commonly grouped under agricultural engineering. There are a vast number of men in this country—farmers and mechanics—who apply engineering in their daily work, but who have had no training in engineering science. Many of these men are unable to get away from their work for any length of time to attend school, and many are unprepared to take up the instruction offered in engineering colleges. These men are not in need of a technical education such as is offered in a college or university, but need such instruction as will enable them to perform their work with greater efficiency. It is for this class of men that this school has been organized.

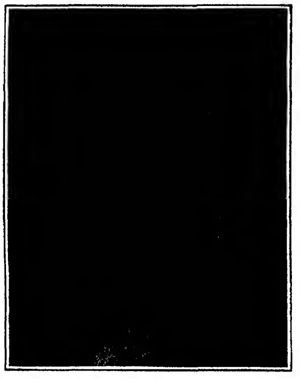
At present courses are offered in gas engines, power-farming, and agricultural engineering. The first course covers the operation of all types of gas engines. The power-farming course gives helpful suggestions on the best methods of applying engines to farm work with definite instruction on the operation of the various farm implements. The course in Agricultural Engineering takes up such important subjects as farm buildings, silos, the use of concrete on the farm, farm machinery, farm lighting systems, heating and ventilation of farm buildings, water supply systems, drainage and irrigation, and road building. It covers engineering subjects which are of special importance to the farmer.

Instruction is given by means of residence, correspondence, and traveling courses. The residence course is maintained at LaPorte, Indiana. Instruction in this school is given by means of lectures and recitations and by practical work on engines [illegible] machines. Arrangements have been [illegible] advanced students in the school may [illegible] of their time in a tractor factory in the [illegible], testing and inspection of engines.

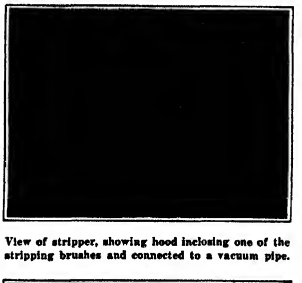
A correspondence course is offered [illegible] who are unable to attend the residence [illegible]. Instruction by correspondence will be given in [illegible] manner as such instruction is given in ot[illegible] correspondence schools with one exception. A [illegible] school will be maintained to give the requ[illegible] actual engines for the students enroll[illegible] correspondence course. This school will vi[illegible] a sufficient number of correspondence [illegible] rolled within reaching distance and gi[illegible] the instruction which can best be given [illegible] of models and working machines. It is th[illegible] the school to combine the practical work o[illegible] the traveling school with the instruction give[illegible], so as to give the student the same opportu[illegible] ing a well-balanced course as he would ha[illegible] ing a residence school.

This part of the school's programme is [illegible] new, but it promises well to solve the questio[illegible] the school to the door of the student who [illegible] to get away for an extended course at a resid[illegible].

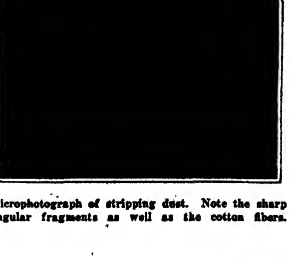
Useless dust (A) collected in the bag, and valuable fiber (B) recovered from the stripping brush.



Vacuum stripper at work on the main cylinder of carding engine.



View of stripper, showing hood inclosing one of the stripping brushes and connected to a vacuum pipe.



Microphotograph of stripping dust. Note the sharp angular fragments as well as the cotton fibers.

Sesame Culture in the Southern [illegible]

SESAME or benne plant (*Sesamum orien[illegible]*) is a native of India, and is now being cultivated in nearly all tropical and semi-tropical regions of the world. The plant is a hairy, sticky annual, about three feet high, and produces an abundance of small, flat, pear-shaped seeds. It was first introduced into the United States before the middle of the seventeenth century, and was cultivated successfully as far north as Burlington, New Jersey. It ripens its seeds in most of the Middle States. Sesame is admirably adapted to the dry soil in the southern part of the United States, Mexico, Central America, Colombia, British Guiana, and other parts of South America. Within a comparatively few years its culture has been undertaken in Germany, France, and England. In Mexico it flourishes in soil scarcely suitable for any other crop, and it is quite probable that the center of the sesame industry in the western hemisphere will soon develop in that country and the southwestern United States, where a good deal of land is allowed to lie idle because it is unfit for most of the other farm crops. The negroes near Charleston, South Carolina, are said to have grown sesame in a small way for over two hundred years.

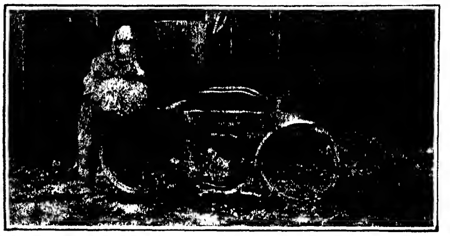
The United States Department of Agriculture is now conducting experiments in the Southwest, and the results thus far attained show conclusively that in many parts this crop will richly repay for planting. The next step on the part of the department officials is to find a market for the crop, and they are now endeavoring to interest the confectioners to use the oil, which is at present obtained from Marseilles in France, where the greater proportion of the commercial oil is expressed.

The chief merit of this crop is that it requires very little cultivation of the soil. It is sown in shallow drills usually from three to four feet apart and about twelve inches apart in the rows. Sowing takes place as early in the spring as possible. In the southern States it requires from the first of April to June for the crop to ripen, but the plants are left in the field until autumn, when the leaves fall off. The stems are then cut, bound in sheaves and stacked in the field to dry. When the oblong pods or capsules which contain numerous small seeds are thoroughly dry, they burst open. A piece of cloth is then spread out on the ground and the sheaves are shaken over it so as to gather the seeds.

An abundance of yellow, mild and bland oil called "gingelly," resembling olive oil, is obtained from the seed. If the oil is of a very good quality, it is employed as an adulterant of oil of almonds, and is of great economic value, only second to cocoanut oil in the variety of its uses. It is employed for culinary purposes, food, medicine, cosmetics, illumination, lubrication, soap-making, etc. The oil is also used in making a very attractive confection, being used like peanut in making a "brittle." The cakes left after the oil has been pressed from the seeds are used as food by the poorer classes and also serves as good food for cattle. The negroes of Mexico are in the habit of crushing or grinding the seeds into a meal for the purpose of making a drink like coffee. The narcotic properties are very pronounced.

The demand in the United States for gingelly oil is constantly increasing, and although the price of the seed is rather low there is undoubtedly a favorable opportunity for developing sesame culture in the Southern States. In case of its production on a scale larger than it is at present it would soon become an economical question, and the price of both seed and oil would increase in value.

A trip to town for a bolt takes little time.



A sack of feed fits on behind.

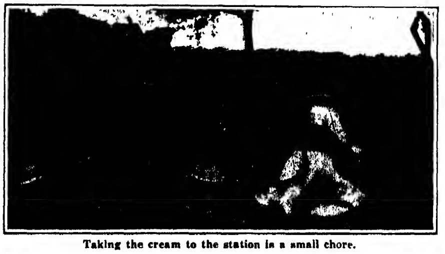
The Motorcycle and the Farmer

By J. M. Palmer.

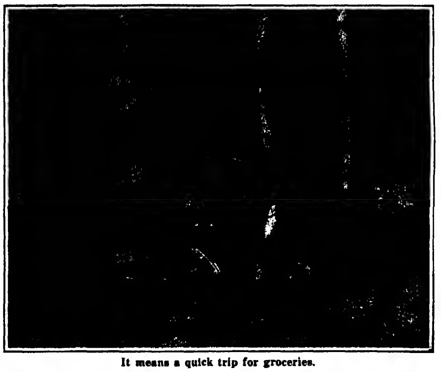
A MOTORCYCLE is a luxury to the city man, but to the farmer it is both a luxury and a business necessity. After the chores are done he can get on his machine, go to town in fifteen or twenty minutes, go to the theater, or spend the evening at the club or park, and not have to put in three or four hours on the road behind the family plug. The motorcycle needs very little care; is inexpensive to operate, and is a piece of machinery that every farmer who can afford it should have.

Leaving out the pleasure side, the motorcycle is very useful on the farm in making quick trips to town Maybe the housewife finds that she is going to run short on groceries for dinner It is only a matter of half an hour to make a trip to town and get the needed supplies. Suppose it is during the wheat harvest and the work is rushing; a bolt or casting is broken and the whole crew is thrown out of work. You can make the trip to town on your motorcycle, get the needed part and have the machine in running order in less than an hour, while if you had to hitch up the family horse and make the trip it probably would take half a day. A motorcycle is very handy in case of emergency. Speed in getting the doctor or some medicine has saved many a life.

Every motorcycle should be equipped with a luggage-carrier. With one of these a load of eight or nine hundred pounds may be carried. One carrier may be attached back of the seat and another in front of the handlebars. In this way a motorcycle may be used in making butter deliveries in town, and taking vegetables and other products to market and exchanging them for groceries and other necessities. A chair attachment may be used on the front of the motorcycle and a luggage-carrier on the back. Two persons can ride then, for pleasure or business.



Taking the cream to the station is a small chore.



It means a quick trip for groceries.

Some persons who own motorcycles use them to run the washing machine, churn, cream separator, and other farm machinery. A belt is attached from the rear wheel to a flywheel on the machine. This is using a motorcycle to a great advantage, but according to a motorcycle expert it should not be used for running machinery. A motorcycle engine is made to be air-cooled, and this will not be properly accomplished unless the machine is in motion. The engine should not be run more than three minutes, standing still, or the piston may begin to stick. The guard must be removed when belting it up, and on some machines this requires considerable time. The machine must also be held steady or it will throw off the belt. This is usually accomplished by means of a rope. If the belt comes off it may get mixed up with the wheel, causing considerable damage. A motorcycle engine will not do its best work unless it is running at about 1,000 revolutions a minute, and this is almost too fast for the average piece of machinery. Some arrangement is needed to reduce the speed. A counter-shaft usually is used for this purpose.

It is not a paying proposition to use a valuable motorcycle engine to run machinery, when a stationary engine can be obtained for a low price to do the same work. In other words, using a motorcycle engine to do this kind of work is like using a fine driving horse for the heavy work on the farm.

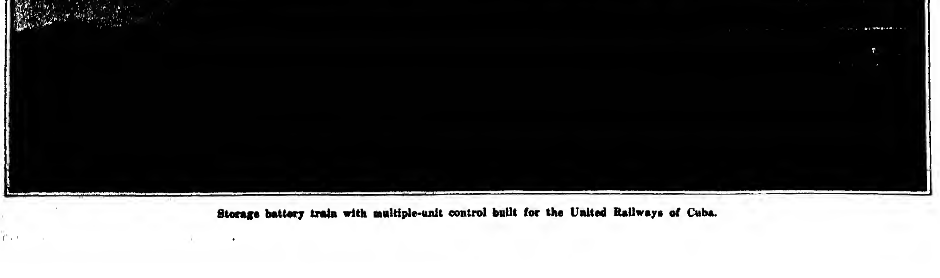
The First Storage Battery Train

THE United Railways of Cuba have ordered an electric storage battery train for use on a line running about one hundred miles out from Havana. Heretofore, this line has operated a train consisting of a steam locomotive drawing a single coach In its place a train consisting of three cars equipped with Edison storage batteries will be used.

A test of this train was made last week over the Long Island Railroad, running from the Pennsylvania Station to Long Beach, a distance of about twenty-five miles. The train was equipped with the multiple unit control; in other words, the separate motors on the cars are operated by a single controller Each car is equipped with 216 cells of Edison battery, furnishing 200 volts to the motors The cars are mounted on double trucks and each car carries four motors. The cars measure thirty-five feet and five inches in length and are provided with four double seats and four end seats having seating accommodation for forty-two passengers

The twenty-five mile trip to Long Beach was covered in fifty-seven minutes on the trip out and fifty-three minutes on the return When Long Beach was reached, the batteries were recharged from the third rail of the Long Island Railroad system, the time of recharging occupying twenty minutes. When the round trip had been completed it was ascertained that the train had consumed four kilowatts per train mile, which at the rate of one cent per kilowatt amounted to $2 for the entire trip of fifty miles The mileage capacity of the batteries is from 60 to 100 miles for seven hours of charging

The great advantage of this form of battery is that it may be recharged at frequent intervals at far above the normal charging rate This periodical recharging or partial charging is known as "boosting." For instance, in Washington a car is being operated over a four-mile line, covering this distance in fifteen minutes There is a delay of three minutes at each terminal, which is occupied in changing the fenders and giving the conductor an opportunity to reset his



Storage battery train with multiple-unit control built for the United Railways of Cuba.

register This three-minute period is sufficient for recharging the batteries at five times the normal rate, with sufficient energy to carry it to the other terminal. The car covers 204 miles per day and the battery is not charged at any other time except during the stops at the terminal.

As the Edison storage battery is of a very rugged character and practically fool-proof, no trouble is anticipated with the operation of the storage cars in Cuba As to the life of the batteries, no figures can be given at the present time for the reason that no batteries of this type have been in service long enough to determine their full life. Batteries have been used for six years without showing any material depreciation

The cars in which these batteries are installed are of a very different construction from the ordinary railroad car The main object has been to reduce weight as far as possible The same principle has been employed in their construction as in the car described in our issue of February 5th, 1910 The design was developed by Mr Ralph A. Beach, who assisted Mr. Edison in adapting his storage battery to traction.

A 7,500 Horse-power Pelton Waterwheel

THE realization of the fact that the sources of the supply of nitrogen, upon which animal and vegetable life so largely depend are strictly limited, and that the consumption of nitrogen compounds is growing at a heavily increasing rate, has led to a close study of the means of increasing the supply of nitrogenous compounds

The most promising and certainly the most lavish source, from which to draw nitrogen for the manufacture of the greatly-needed compound, is the atmosphere, and this branch of the nitrogen industry is growing at such a rapid rate that it promises to become, ultimately, one of the largest in the industrial world

The same natural conditions of an abundant supply of hydraulic power, which caused the first plant for the fixation of nitrogen in the United States to be located at Niagara Falls, has turned the attention of the capitalist to Norway, whose lakes and rivers, with their lofty elevation and rapid fall, provide ideal conditions for the cheap production of hydro-electric power. Of the several plants in that country the most interesting is that which utilizes the Rjukan Fall, which constitutes the principal fall in the descent of the Maana River through which the waters of Lake Mosvand find an outlet into Lake Tinn Lake Mosvand is a body of water, with a surface of twenty-three square miles, which lies at an elevation of three thousand feet above sea level. By means of a dam the level of the lake is raised over forty-six feet, and the water power available is increased from 30,000 to 250,000 horse-power, at an outlay of a little less than $2 per extra horse-power.

Five miles below the dam another dam forms the intake for the power station, and from this intake the water is led through a tunnel to a reservoir formed at the brow of the cliff near the Rjukan Fall. The tunnel is 2.6 miles long and has a descent of one in 300 A thousand feet below the terminal reservoir of the tunnel is the power station, which is located on a shelf in the face of the cliff. The water is led from the reservoir on the mountain side to the power station through ten large flumes, placed side by side. The flumes are five feet in diameter, the upper sections being built of riveted steel plate, the lower sections, where the pressure reaches 450 pounds to the square inch, are made of welded plates one inch in thickness The water descends 971 feet to the turbines. The effective height after deducting losses through friction, etc., is 900 feet.

After leaving the power station, the water enters another tunnel excavated in the side of the cliff and extending 3.1 miles down the valley It there enters another series of flumes, through which it drops 909 feet to a second power house, which is a duplicate of the one mentioned above

The upper power house is completed and the lower one is now under construction In the Vemork power house, as it is called, are ten units each of 15,000 horse-power, with a maximum capacity of 17,500 horse-power Each unit consists of two large Pelton waterwheels, installed side by side on common shaft, upon which are mounted also double generators A three-phase, alternating current of 50 periods is transmitted from this power house to the nitrate works, through sixty wires, partly of copper, but chiefly of aluminium. The working voltage is 10,000. The Pelton waterwheel, which is very extensively used in the mining districts of the mountains of our Western States, is particularly adapted to very high pressures and relatively small volumes of water The early wheels were small and were run at extremely high velocities; but of late years it has been recognized that this type of wheel can be built in larger sizes and run at rates of revolution, which render it possible to direct-connect it to generators of large size operating at moderate rates of speed.

At the Rjukan installation the water is delivered in two jets of high velocity. It strikes on the raised center of the cups (see front page illustration), and is deflected to each side, leaving the cups in a direction which is tangential to their outer edges. The direction of motion is changed nearly 180 degrees. Theoretically, the velocity of the cups should be equal to one half the velocity of the jet, and in this case the efficiency of the wheel would be 100 per cent. There is a loss of efficiency, however, due to the friction of the water in the cups and the energy loss due to the loss of velocity of the water as it leaves the cup. In well-designed wheels of the larger sizes, however, the efficiency has been carried up to about ninety per cent.

The International Rubber and Allied Trades Exhibition

THE International Rubber and Allied Trades Exhibition was formally opened at noon on September 23d, in the Grand Central Palace, New York city. An enormous amount of raw rubber was exhibited, the value of which is estimated at about $400,000.

In a felicitously worded speech, Commissioner Calvin Tomkins, who represented Mayor Gaynor, dwelt upon the importance of the rubber industry to America.

"Ever since the rubber industry as we know it began to develop with the discovery of vulcanization," said Mr. Tomkins, "America has been the principal user and manufacturer of rubber. To-day we use more than one half of the total production of the world's raw rubber, and in value the output of the finished product equals the value of steel production."

"In this great and representative exhibition two things especially will strike most people: first, the fine machinery, mostly American, which is employed either in working the rubber in its earliest and crudest stages or in utilizing it in its finished forms for all sorts of purposes, from hose to overshoes, from tires for automobiles to toys for the nursery, from deep sea cables to flooring, such as that over which those attending the exhibition will walk when entering the hall. The second striking thing is the rivalry—a perfectly friendly rivalry, but a very serious rivalry—which exists for premier position in the market between what is called wild rubber and plantation or cultivated rubber

"Brazil is the home of rubber. Without the fine trees of the Amazon forest, which for centuries have been yielding the precious milk from which rubber is made, a mighty industry would have been impossible. It was hardly to be supposed that so valuable a national asset would be allowed to develop without rivalry. Thirty-five or thirty-six years ago some thousands of seeds were taken from Brazil and planted in India, in Ceylon and in the Malay Estates. The results of the successful germination of these seeds has been so remarkable that within a couple of years or so from the present time, the output of plantation rubber will probably be at least as great as that from Brazil.

"As the world's consumption of raw rubber bids fair to exceed one hundred thousand tons a year—apart, that is, from the enormous quantities of reclaimed rubber which are used every year—we have here a very interesting situation, which is being watched with eager attention, not only in Brazil and in the East, but also by the manufacturing markets of two continents.

"Rubber has become indispensable to the progress and civilization of the world Great scientific minds are devoting themselves to the elucidation of the many problems it opens up. The laboratories of Europe and America are engaged in a ceaseless round of experiments, both as to the character of the rubber and the uses to which it may be put. Some day we are even promised rubber roadways and silent cities. The support given to this exposition has been world wide. Twenty governments are represented, and among those who are taking part in it are the Philippines and the Hawaiian Islands I understand that there are one hundred foreign delegates to the Rubber Conference which is to be held in connection with the exhibition—experts in rubber growing, rubber chemistry, and rubber manufacture—who will contribute addresses and papers, the value of which cannot be over-estimated."

The International Congress of Hygiene and Demography

ACCORDING to the official estimate, fully ten thousand persons visited the exhibition in connection with the International Congress of Hygiene and Demography on September 22d. The exhibits are essentially popular in character. Tables, diagrams, mottoes concerning the use of alcohol and the trouble resulting from it; the nature of various diseases, and the measures that should be taken to prevent infection or contagion are striking features of the exposition. Boy scouts will give regular-hourly drills, athletic [illegible] cises and exhibitions of methods of rendering [illegible] injured persons, in cooking, in cleaning [illegible] There is a municipal bathing pool which will be [illegible] for the water events. An area of approximately [illegible]ty acres will be used for the various camps an[illegible] cises. More than one thousand children from [illegible] playground associations will participate in pla[illegible] contests.

Every day there will be practical demonstra[illegible] treatment of live patients and dummies will be [illegible] surgical operations. Every organ, muscle and li[illegible] and bone in the human body is represented [illegible] dummies. There is a model field hospital equi[illegible] which is said to be the finest of its kind in the [illegible] There are three health exhibit cars, which we[illegible] one each from Maryland, Louisiana and Cali[illegible]. The California and Louisiana cars contain maps, [illegible]graphs, charts and models dealing especially with [illegible] problems of health and sanitation in rural dist[illegible], some of them being planned on novel and impre[illegible] lines. A course of hourly lectures is given in each [illegible] these cars.

The Congress itself was opened by President [illegible]. The address of welcome was made by Dr. Max [illegible]ner, of Berlin.

When the roll of nations was called, delegates from thirty three foreign States answered. Among the more prominent were Sir Thomas Oliver of the University of Durham College of Medicine, Newcastle, England; Dr. Jacques Bertillon, Chief of the Bureau of Municipal Statistics, Paris, a brother of Prof. A. Bertillon, the criminologist; Dr. Friedrich Zahn, Director of the Bavarian Municipal Office, Munich; Dr. Arbold Netter, of the Faculty of Medicine, Paris; Major-General Eugene de Kontwokski, St. Petersburg, Russia; Prof. Shibasaburo Kitazato, of the Japanese Imperial Institute for the Study of Infectious Diseases, Tokio; Dr. Francis Harbitz, of King Friedrich University, Christiania, Norway; Dr. Carl Landsteiner of the University of Vienna; Dr. Alfred Pettersson of Stockholm, Sweden; Dr. Paul Romer, of the Hygenic Institute, Marburg, Germany; Dr. Lucien March, Director of General Statistics, France; Dr. Alfredo da Graca Couto of the Federal Department of Health, Rio de Janiero, Brazil; and Dr. Lugi Cadliani of the University of Turin, Italy.

Types of Aeroplanes for Military Service

UNTIL further notice, the intention of the Army aviation service is to purchase and use only two types of aeroplanes.

One type will be known as "Speed Scout" aeroplane. This type is desired particularly for strategical reconnaissance, carrying only one aviator without passenger, and having a radius of operation of about 100 miles and a speed of not less than 65 miles per hour. With this type of aeroplane a military aviator is expected to locate and report large bodies of troops. This machine should be capable of ascending at the rate of about 600 feet per minute.

The second type will be known as "Scout" machine. It is desired for reconnaissance service when hostile armies are in contact or approaching contact. This service requires a weight-carrying aeroplane, the crew consisting of two aviators, capable of relieving each other as observers; the aeroplane should be provided with radio equipment. This type of aeroplane should remain in the air at least three hours to permit the observers to locate smaller bodies of troops accurately upon a map, make sketches, military photographs, etc. The Scout aeroplane should have a speed of not less than 45 miles an hour; the maximum speed must not exceed 60 miles per hour. It should be capable of carrying a useful weight of 450 pounds, and with this weight ascend at least 2,000 feet in 10 minutes. The chassis must be designed so that it is capable of landing on and arising from soft ground, such as harrowed fields.

Porous Metals

USING an alloy of lead and antimony, containing 90 per cent lead, and one of tin and lead, containing 80 per cent of tin, Hannover has obtained both porous lead and tin. The porous lead thus obtained may be used for many purposes, and would be especially valuable in making accumulator plates of very large capacity.

The Most Costly Porcelain Service

AT an exhibition of works of art, at present being held in St. Petersburg, there may be seen a set of porcelain dishes which is considered the most costly in the world. It consists of 86 hand colored plates. This set has an estimated value of 86,000 rubles ($18,540), a single plate, therefore, being worth 1,000 rubles ($515). It is the property of Count Orloff-Davidoff.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Columbia River Jetties

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of August 24th, 1912, on page 160, is an article headed "The Harbors of the Pacific Coast." In this article is a statement regarding the time necessary to complete the project for a deep-water entrance at the mouth of the Columbia River, which has been very harmful to this port, and which is so far from the true facts, that we have asked the United States engineers to furnish a correct statement of the matter, a copy of which I am inclosing. We would ask that you publish same in at least as prominent a position as was the article which it is proposed to correct.

PORTLAND CHAMBER OF COMMERCE,
By EDMOND C. GILTNER,
Portland, Oregon. *Secretary.*

[We take pleasure in publishing the following letter of Major McIndoe. Mr. Ballou informs us that the statements in his article were based on the last annual report of the Chief of Engineers, U. S. A.—EDITOR.]

Edmond C. Giltner,
Secretary, Chamber of Commerce,
Portland, Oregon.

1. Referring to your letter of September 12th, 1912, inclosing a clipping from the SCIENTIFIC AMERICAN relative to the jetties at the mouth of the Columbia River, I wish to say that I read the article about a week ago and made note of it with the intention of writing to the Editor, calling his attention to the erroneous statements published in the paper prepared by William Hosea Ballou, Sc.D.

2. Instead of only about 19,000 feet of the south jetty being completed on the first of June, 1912, this jetty was practically seven miles long and nearly completed, the only work remaining to be done at that date being the completion of the groins, extension of jetty apron, and the filling up of some low places, which work should be entirely completed in about six working months. Instead of "twelve years to complete the present south jetty," it is confidently expected that it will be completed in the early spring of 1913, and that its maintenance will not require the dumping of more than a small amount of rock in the next few years, while the trestle remains serviceable.

3. The proposed north jetty, instead of being two thirds as long as the south jetty, is only a little over one third as long, and should not cost more than one half the amount expended on the latter. Instead of sixteen years to complete the north jetty, as stated by Mr. Ballou, a most liberal estimate would be six years, so that Portland can hope for the full depth which the jetties will give across the bar in about seven years instead of "twenty-eight years." Preliminary work for the north jetty, including construction of receiving wharf, storage yards, etc., is now well under way, and it is hoped that dumping of rock in the north jetty can be commenced during the summer of 1913. Within one year after the construction of the north jetty is begun, it is expected that its effect on the bar will be noticeable by increased depths, and that this increase of depth will continue with the advance of the jetty work until the desired 40-foot channel results.

4. During the fiscal year ending June 30th, 1912, the best channel remained fixed in position, the survey completed in June, 1912, showing it to be almost exactly in the same position as in June, 1911.

(Signed) J. F. MCINDOE,
Portland, Oregon. *Major, Corps of Engineers.*

The Flight of Projectiles

To the Editor of the SCIENTIFIC AMERICAN:

An article on the flight of projectiles by Rear-Admiral N. C. Twining, U. S. N., appeared in your issue of August 17th.

He states that a projectile must move nearly point on throughout its flight, owing to the fact that retardation from the resistance of the air is less toward the end of its flight than at the beginning, which could not be if the projectile traveled more or less sidewise toward the end of its flight.

He states that the point of the bullet deviates farther from the trajectory as the range increases, and that this increased deviation causes drift.

That is, according to the first contention, the point of the bullet deviates no more, and probably less, from its trajectory toward the end of its flight than at the beginning, whereas, according to the second contention, the point of the bullet deviates more from its trajectory toward the end of its flight than at the beginning.

These two contentions contradict each other, and one at least must be wrong.

He compares the twist of a baseball to the twist of a bullet. This comparison seems wholly visionary when it is considered that a baseball is rotated on an axis more or less at right angles to its trajectory, whereas a projectile is rotated on an axis practically identical with its trajectory.

I offered some years ago to demonstrate to the authorities of Canada, Britain, and the United States as well as to numerous manufacturers the cause of drift and other things, and to point out how shooting, especially with small arms, could be very much improved with little or no increase in cost, but no notice was taken of the offer.

I could not get opinions from any of these people concerning the flight of projectiles.

The article in your issue of August 17th seems to demonstrate that little or nothing is known concerning the flight of projectiles by those in a position to make use of the knowledge. C. C. GRANT.

Red Deer, Alberta.

Another Card Puzzle

To the Editor of the SCIENTIFIC AMERICAN:

I have read with interest the description of the "four island" card puzzle in a recent issue of the SCIENTIFIC AMERICAN and it recalls another card puzzle which I will now describe. Let a person take a pack of cards, remove the joker, and then lay out three piles, lapping the cards of each pile one upon the other so that the denomination of the lower or initial card of each pile can be seen. In placing the piles, count from the initial card up to ten, then if the initial card be a six, count on that seven, eight, nine and ten or four cards just as they come from the pack. If the initial card of the second pile be a seven, place on that cards to count up to ten, or three cards, and if the initial card of the third pile be a five, it will require five cards to count up to ten. The game is for the player without seeing the three piles to tell the sum total of the spots or numerical values of the three initial cards, the party placing the piles to give the player the balance of the deck after he has placed the three piles. This sum total the player can readily determine by subtracting nineteen from the number of cards in the balance of the deck handed him by the party. In showing the puzzle the player can stand with his back to the other party when the cards are being placed in the three piles, and while the explanation of the trick is simple, it is at first mystifying. The face cards can be given any desired number value in playing the trick, care being taken that the value so given is the same in starting the card piles and in calculating the total values of the initial cards. OBSERVER.

Washington, D. C.

The Bureau of Chemistry

To the Editor of the SCIENTIFIC AMERICAN

To designate the methods of the Bureau as "unscientific" is not fair, as it is not in accord with fact. The chiefs of divisions, the laboratory chiefs, and the laboratory assistants, one and all, are men of high educational qualifications. All are university graduates, and many of them have done considerable graduate work. Furthermore, most of them have had considerable practical experience in the study of food materials in field and in factory. The Referee Board does not and cannot check up the work done in the several United States food and drugs laboratories. This Board is authorized to investigate and to report upon certain problems under dispute. The Board does not in any way direct or control the work of the several laboratories. While I fully admit the usefulness of the Referee Board, I do not admit that its maintenance is an absolute necessity. I believe, however, that for a few years more, the Board will be a benefit.

You make certain allusion to differences of opinion between interested manufacturers and those whose duty it is to enforce the law. My dear sir, every manufacturer of foods and drugs, even though he knows that the articles manufactured are useless and harmful, will declare most emphatically against the findings in the pure food and drug laboratories. These interests will very naturally oppose anything which hurts their business. Your charge of incompetence against the Bureau is not in accord with the facts we already pointed out. The analysts in the laboratories are not only highly qualified, but they are scientifically honest, knowing full well that any attempt to "prepare cooked-up evidence" would certainly be discovered in the several "checks" to which every analytical laboratory report is subjected (by laboratory chief, division chief, chief of bureau, and check analyses).

It is indeed much to be regretted that crooked manufacturers with money enough to fight in the courts have time and again diverted and annulled the ends of justice. We are all satisfied that nostrums and fake remedies should not exist, and the manufacturers thereof should be punished under the law. It is true some have been brought to time, but not all. We would indeed be pleased to be informed how these offenders may be more generously and more expeditiously punished. The Bureau is doing all it can.

You criticise the division chiefs in the Bureau, with special reference to Bigelow, Kebler, and Doolittle. The last one named has been "acting chief" of the Bureau since the resignation of Dr. H. W. Wiley, and in the capacity of mere "filler in" he has been doing remarkably well. Bigelow and Kebler have done many years of most efficient work, their ability, honesty, and integrity have never been questioned. If they have often failed to bring wrong-doers to justice, the fault has, as a rule, not been theirs, which brings me to my closing statements.

1. The Bureau of Chemistry is sorely in need of older, more experienced, better qualified assistant U. S. district attorneys. In fact, the administration of the Pure Food and Drugs Act calls for attorneys having special educational and experience qualifications. The Bureau has time and again lost cases simply because of the inefficiency of the assistants assigned to the cases by the U. S. District Attorney.

2. The Bureau must not have in its personnel anyone who is not heartily in sympathy with the enforcement of the spirit of the Pure Food and Drugs Act. This should apply to all divisions of the Bureau, inclusive of laboratory assistants. This has not been the case in the past, as all informed persons know.

3. For some time to come, the Bureau should center its efforts upon the flagrant transgressors and bring these to time. This will keep all hands busy for say ten to fifteen years. Afterward we can take up the minor technical offenders.

4. The Bureau will no doubt welcome all help and good advice. The Bureau pays no attention to knockers.

San Francisco, Cal. ALBERT SCHNEIDER.

[Our correspondent is not familiar with the conditions in the Bureau of Chemistry.

He is wrong, for example, in assuming that the chiefs of divisions are men of high qualifications. Mr. Bigelow, for example, is not regarded by scientific men as an authority on food chemistry. It is impossible to find any authoritative work of his which would entitle him to serious consideration as a physiological chemist. We have no question that he is an honest and zealous official; but we do question his scientific competency to pass upon very important and very novel questions that involve the health of ninety million people. Dr. Kebler is a graduate of Michigan University and of the George Washington University. He has never performed any research work of the character which would entitle him to be regarded as eminently qualified to hold the important position that he does. Moreover, in the Chattanooga trial of the Coca-Cola case, it appeared that in experiments conducted under his direction, rabbits had been drowned instead of poisoned (as he supposed) by running a tube down their lungs instead of their stomachs. That is sufficient evidence of his scientific incompetence. Like Mr. Bigelow, we have no doubt that he is honest and zealous, we simply doubt his scientific ability.

Mr. Doolittle was once State analyst for Michigan. The appointment was made in the face of very hostile criticism; for Mr. Doolittle's competency was very much questioned. He has never done original work of such a character that scientific men regard him as an authority on physiological chemistry or the chemistry of food.

We agree with Mr. Schneider that there are many men in the Bureau of Chemistry whose educational qualifications are high, who have done remarkably able work in their special fields and who may well be regarded as true scientists. But the trouble is, under the present administration, it is impossible for these men to do effective work.

It is true that the Referee Board does not and cannot check up the work done in the several United States food and drug laboratories. But the Board does and can check up disputed matters. The benzoate of soda investigations were made by a medical student who had not even an M.D. He graduated from an institution which Dr. Abraham Flexner of the Carnegie Foundation for the Advancement of Teaching considered poorly equipped for the purpose of imparting medical instruction, and the discontinuance of which institution Dr. Flexner strongly recommended. Naturally, when men like Dr. Remsen repeat the experiments on a larger scale and with greater scientific care, the result is quite different. What would we have done without the Referee Board in the benzoate of soda and other cases? If ever there was a shining example of scientific incompetence, we find it in the manner in which these benzoate of soda studies were conducted. It would be absolutely unnecessary to maintain a Referee Board if the Bureau of Chemistry did its work with the scientific care that we have a right to expect from a Government institution which has unlimited funds to spend.

We agree with Mr. Schneider that interested manufacturers will do all in their power to evade the Pure Food and Drugs Act. Our point is that they find evasion particularly easy because of the incompetence of the Bureau of Chemistry.—EDITOR.]

Landsman's Log Aboard the United States Destroyer "Patterson"—I

By J. Bernard Walker

The present series of articles is a record of impressions gathered by the Editor, on a week's cruise aboard the destroyer "Patterson," during the summer maneuvers at the eastern entrance to Long Island Sound.

Captain and officers of the "Patterson," flagship of the Fourth Group of torpedo-boat destroyers.

Through the signalmen and the wireless the flagship sees, hears and talks with the fleet.

IT was a faultless July morning when we took a motorboat at the docks at Newport, Rhode Island, ran around the breakwater which extends from the island on which the torpedo station is located, and drew alongside the gangway of the United States destroyer "Patterson." Looked at from the water, the great length and generous freeboard, and particularly the lofty fore deck of the vessel, combined to give an impression of power and seaworthiness which was very convincing. From the flimsy "boat" of twenty to twenty-five years ago the torpedo craft has developed into the "ship," strong, swift and seagoing. The impression was deepened as I stood on the main deck and took in the long sweep of her, from the break of the forecastle to the taffrail at her stern; and again when I went forward and entered the comfortable officers' quarters below the forecastle deck.

Here an alleyway on the starboard side terminated in the captain's cabin, a commodious room extending across the ship, where I received a cordial greeting from Capt. John M Luby, commanding the fourth destroyer group. Aft of the captain's cabin, on the port side, are three officers' staterooms, in one of which the writer was most comfortably domiciled. Aft of these is the wardroom mess, a snug little room with comfortable seating accommodation for four at the dining table Adjoining this, to port, is the officers' galley.

At the break of the forecastle are two 3-inch semi-automatic guns, one on each beam, the forecastle structure being cut away so as to permit these guns to fire dead ahead Amidships on the main deck, one on each beam, are two twin 18-inch torpedo-tubes, mounted so that they can be swung through a wide arc by a man who, seated above the tubes, with his eye at a telescopic sight, trains them with great accuracy upon the target by means of a wheel not unlike an auto steering wheel. Amidships on the main deck is another 3-inch gun, and astern are a third twin torpedo-tube and a 3-inch automatic gun. Forward on the forecastle deck is yet another 3-inch gun, making in all five of these effective pieces.

Below the main deck are storerooms, berthing spaces for the crew, the two boiler-rooms, each containing two oil-fired water-tube boilers, the turbine-room, additional berthing space for the seamen, the quarters of the petty officers, and astern of all the doctor's stores and other general stores of the ship

While we were waiting for the signal to weigh anchor and proceed to sea, the writer took the opportunity to gather a few particulars of dimensions, etc., and incidentally receive an impression of the ship, particularly in regard to that remarkable lightness of construction which we have all come to associate with the torpedo boat and the destroyer. The "Patterson" is nearly three hundred feet in length over all, or to be exact, two hundred and ninety-four feet Her molded depth from main deck to keel is sixteen feet; draught, eight feet; beam, twenty-seven feet. The main deck is about nine feet above the water line, the forecastle deck seventeen feet above the same level, and the bridge about twenty-four feet. The ratio of length to beam is one to eleven; a proportion which will enable the reader to understand how extremely fine are the lines of these phenomenal craft. The complement of the "Patterson" is four officers and eighty-five men, and her normal displacement is about seven hundred and sixty tons. She is driven by turbines operating three propellers, and on her trials she indicated about 15,000 horse-power and attained a speed of slightly over thirty-three knots.

My first impression of the destroyer as the result of that half hour's inspection was of the thoroughly workmanlike appearance of the ship, due to the absolute absence of anything of the ornamental. It is true, she exhibited all the characteristic orderliness of a naval ship; but there was everywhere evidence that a torpedo-boat destroyer is designed for arduous and dangerous service, and built with a sole eye to securing a maximum efficiency for every pound of material and dollar of expense.

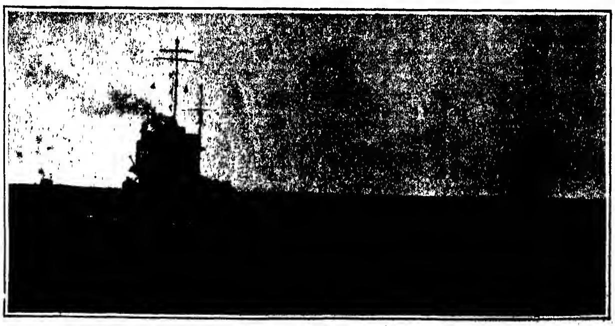
Structurally the most wonderful thing about the "Patterson" is the combination of lightness and strength in her construction. Remembering that she is about three hundred feet in length, and that the bending stresses, tending to break her back when she is being driven into head seas, must reach a very high figure, it is astounding to learn that her keel plate is only 5/16 of an inch in thickness, her garboard strake and maindeck stringer 1/4 of an inch, and that the rest of the plating on sides and deck is 3/16 of an inch in thickness only. Equally light is her framing: 3-inch bulb angles for the frames, with deeper, 9-inch web frames at every twelve feet of her length. Considerable transverse stiffness is afforded, however, by the eleven watertight bulkheads, which assist in holding the hull to shape. Also, it must not be forgotten that a series of deep longitudinals runs through the bottom of the ship, while the main deck is immensely stiffened by two 12-inch I-beams, worked along the inner edge of the main-deck stringers, and two 18-inch I-beams, which extend through two thirds of the length of the ship on each side of the boiler-room and engine-room hatchways. Enough has been said to show that these vessels are of astonishingly light construction; and the fact that the "Patterson" went through that terrific three days' gale, early in the year, when the Atlantic fleet was on its way to Gauntanamo, Cuba, without the slightest sign of structural weakness, speaks volumes for the excellence of the design and the high character of the workmanship of these very fine boats.

But the flagship has made signal to get under way, and going up on the bridge, we learn what are to be the maneuvers for the day. A fleet of eight battleships is leaving Newport Harbor for the open sea, although the harbor is known to be blocked by a group of nine submarines, which are cruising off the entrance to the harbor, well outside the range of the shore batteries. The battleships are to steam out in column protected by a screen of nineteen destroyers. At present, our destroyer fleet in commission consists of four groups, with five ships in each group; although on this particular day we have but nineteen boats available, the "Warrington" being still at Newport News, having a new stern built on to replace the one that was cut off by a sailing schooner during a gale of wind last winter.

The duty of the destroyers is to form a screen entirely around the fleet, the boats steaming at such distances from one another that the chance of a submarine slipping by without being sighted will be reduced to a minimum.

As we left the harbor, two divisions, or nine boats, forming the van, led the way in wedge-shaped formation, being distant two or three miles ahead of the leading ship of the battleship line. A mile or so to starboard, steaming on a parallel course, in line ahead, was a group of five destroyers. An equal distance to port was our group, steaming also in a parallel column formation, with the flagship "Patterson" in the van. As we reached the mouth of the harbor, the leading groups, being on divergent courses, gradually opened out their distances from one another, until they were spread over a wide reach of the Sound in fan-shaped formation, the boats being at a distance, say, of a mile and a half from each other. The speed of the fleet had been raised to fifteen knots, and as we drew out beyond range of protection by the shore batteries, a keen lookout was kept for the tell-tale periscopes of the submarines, which, seen at a distance, look no larger than a pair of lead pencils.

There was a long and rather heavy swell rolling in from the sea, and as we changed course, taking the sea on the broadside, I saw some of the most extraordinary rolling on the part of the destroyers that it is possible to imagine. The easy bilge and generally fine form of the underwater body of these boats and the disposition of weights are such as to conduce to quick motion and an extreme angle of roll. Even in the moderate sea that was running, the "Patterson" soon commenced to swing from twenty-five to thirty degrees each side of the perpendicular. This, I was informed, was moderate in com-



"Our group' went through a series of evolutions which displayed the facility and accuracy with which these craft are handled."

[illegible] to what these boats are capable of; for in heavy weather, the "Paterson" has rolled as much as forty-five degrees each side of the vertical, or through an arc of ninety degrees in all, and at times has reached seventy degrees. The eyes of the officers on the bridge are at a height of about twenty-five feet above the water line, and the period of roll is about five seconds. One of our officers with a mathematical turn of mind, figured out for me that the maximum speed with which those on the bridge were swept through the arc described during the excessive rolling of the great January storm was somewhere between twenty and twenty-five miles an hour! Just think of that, ye landsmen, whose experience of the sea is confined to the slow and easy motion of a forty-thousand-ton ocean liner! I had heard, and could now well believe, that a destroyer is one of the most uncomfortable of boats, and that a gale at sea is a heavy strain upon the physical endurance of those on board. The motions are quick, constantly changing, and frequently unexpected. The muscular tension of the body cannot be relaxed for a moment, not even when lying down in a bunk to snatch a badly-needed sleep.

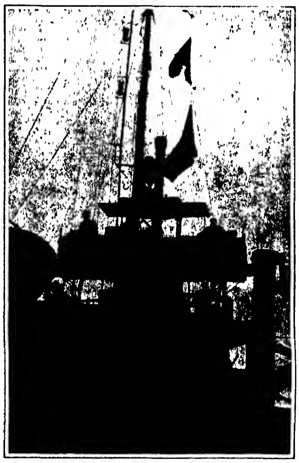
Nevertheless, to the honor of our naval officers let it be known, that there is no service so popular as the torpedo service. Certainly there can be no branch of the service which affords such splendid experience and training for those younger officers who, later, are to become the captains and admirals of our larger ships. The high speed, frequently over thirty knots, the complicated maneuvers, many of them carried out on the darkest nights, without a light showing on any one of the fleet, call for the quick eye, the steady hand, and swift decision, evidence of which I was to see, a day or two later, during the night maneuvers.

But to return to our story. Somewhere in that wide stretch of tumbling sea ahead and on either flank of the far-flung screen of destroyers were the nine submarines—not gathered in any well-defined group, but in all probability scattered so as to make their attack from widely separated points. The bright sun of the morning had disappeared, and sky and sea presented a monotone of dull gray, relieved only by the occasional broken crests of the heavier seas. To the inexperienced eye of the landsman, it seemed as though the detection at a distance of so small an object as a submarine, even if she were running awash with deck and conning tower exposed, would be a matter of pure luck; and when I remembered that the little craft were all of them by this time fifteen feet below the surface, and taking careful note of the position, course and speed of every one of our nineteen scouts, and that they were doing this at the slight risk of showing only the tops of their slender periscopes above water, it seemed as though our task of discovering, and if possible sinking these little fellows was one of insuperable difficulty. But the lookouts are special men, chosen because of their quick eyesight; and the readiness with which they "picked up" the submarines with the naked eye was surprising.

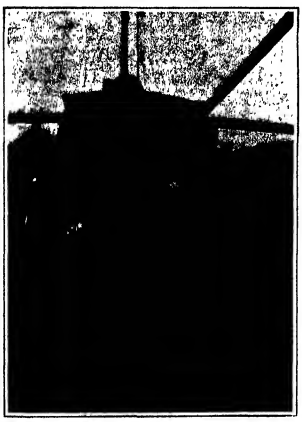
If the submarine could only see through the water, defense by a screen of destroyers would be hopeless; but in making an attack on a moving fleet it is absolutely necessary for the submarine to thrust its periscopic eyes above water occasionally, both to take note of the movements of the enemy and to correct its own course; and I saw enough on that afternoon to be satisfied that a far-flung screen of destroyers is a most efficient protection for a battleship fleet—at least when it is in motion—against this most dreaded of all forms of attack. Just here, it would be well to point the moral that one of the greatest needs of the United States Navy to-day is an adequate fleet of destroyers. It has come to be accepted among the leading naval powers that for every battleship there should be four destroyers. How far our Navy falls below this mark is shown by the fact that although we possess a total of thirty-seven battleships built, building or authorized, we have at present only thirty-seven destroyers

(Concluded on page 287.)

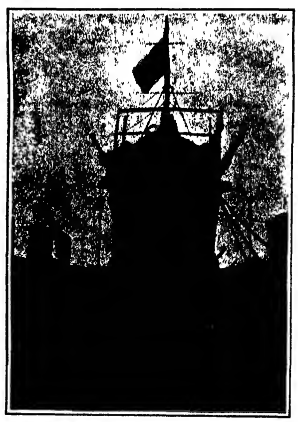
"From the flimsy 'boat' of twenty to twenty-five years ago, the torpedo craft has developed into the 'ship,' strong, swift, and seagoing."



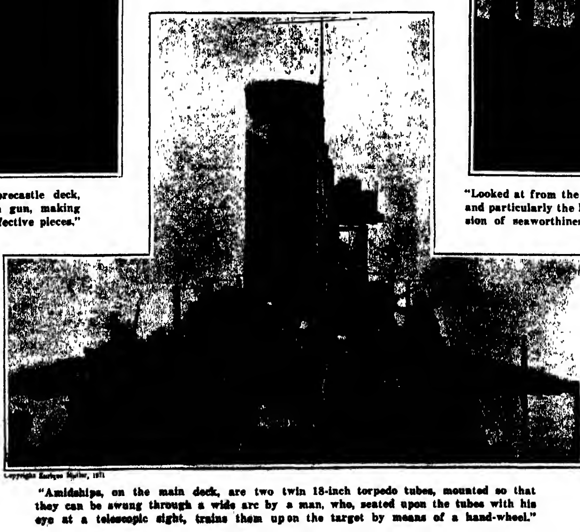
Bridge from main deck, showing signal flags on right and Ardois electric lamps on left for day and night signalling.



"Forward, on the forecastle deck, is yet another 3-inch gun, making in all five of these effective pieces."



"Looked at from the water, the generous freeboard and particularly the lofty fore deck gave an impression of seaworthiness that was very convincing."



"Amidships, on the main deck, are two twin 18-inch torpedo tubes, mounted so that they can be swung through a wide arc by a man, who, seated upon the tubes with his eye at a telescopic sight, trains them upon the target by means of a hand-wheel."

The Heavens in October

Recapture of the Tiny Planet 1911 MT.

By Henry Norris Russell, Ph.D.

Easily first in interest among the astronomical announcements of the past summer is the recapture—if we may so speak—of the very remarkable asteroid known as 1911 *MT*.

The history of this little body has afforded quite an astronomical romance, which nearly turned out, as has been well said, to be an astronomical tragedy.

On October 3d, 1911, Prof. Palisa of Vienna, a distinguished observer of the minor planets, while observing another object, noticed that one of a pair of faint stars in the field of view of his telescope had changed its position relative to the other. A few minutes measures showed which one was moving, and made it clear that an object of unusual interest had been discovered; for the new asteroid was moving rapidly southward and *eastward*.

The little planet was almost in opposition to the Sun, and when in this relative position, practically all the known planets and asteroids seem to move westward. They are all really moving eastward, it is true, around the Sun; but the eastward motion of all previously known planets (except Eros near perihelion) is slower than that of the Earth, so that we leave them behind, and they seem to move toward the west.

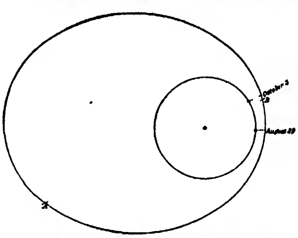
The news of the discovery was spread abroad by telegraph, and on the following night another observation was secured by Palisa, and two by Pechule at Copenhagen, but then bad weather set in; the Moon came along and made the sky too bright to see faint stars, and, after she had gone, the new planet was lost, and could not be recovered, though photographs of the region in which it might be expected to be, were taken with powerful instruments.

So the situation remained for several months. The existing observations of the asteroid were confined to two days, and did not afford enough material for the computation of a reliable orbit by the ordinary methods. However, an attack on the problem was made by Mr. Haynes of the University of California, using certain very powerful methods of calculation developed by Prof. Leuschner of that university, and he succeeded in getting an approximate orbit, which was published last April. From this an approximate ephemeris of the planet's tract was calculated, and, when this was available, images of the planet were found on three plates taken at Greenwich on October 11th, and on one obtained at Heidelberg on October 17th. These images were faint, and had previously been overlooked, but were found when it was known approximately where to search for them.

With the aid of these observations, Mr. Haynes has computed a second and much more accurate orbit, and an improved search ephemeris. Thanks to this, the planet has been identified on a plate taken at Heidelberg in the middle of September, and one exposed at Johannesburg on October 18th. With this interval of a month between our extreme observations, a good orbit can be obtained, and it is possible that still more observations may turn up, for the planet was well placed in the northern sky, and fully as bright as at discovery, all through August and September, and more images may be found on plates exposed for other purposes to the proper region of the sky.

The orbit of this remarkable member of our solar system is shown in the accompanying illustration. It is remarkable for its great eccentricity, which exceeds that of any previously known planet. When nearest to the Sun, it is but 110,000,000 miles from him, and about 19,000,000 from the Earth's orbit, while its greatest distance from the Sun is 366,000,000 miles, and its distance from the Earth may reach 459,000,000.

The orbit is inclined nearly 11 degrees to the plane



Orbits of the Earth and Planet 1911 MT.

of the ecliptic, crossing it at the points marked *A* and *B* in the figure, so that when nearest the Sun it is north of the Earth's orbital plane, and a little farther from our track than the diagram would indicate.

At the time of discovery it had just passed as near the Earth as it could possibly come—as the figure shows, by giving the positions of the two bodies on October 3d, 1911 (the discovery date) and on August 29th, when the planet was nearest the Sun. The planet's motion in this part of its orbit is actually faster than the Earth's motion, which accounts for its apparent eastward motion in the sky. As the two swung farther around their paths they rapidly separated, which caused a steady decline in the apparent brightness of the planet, which explains why it was so nearly lost.

This little planet must be one of the very smallest bodies so far known to astronomical observation. When discovered, at a distance of only 23,000,000 miles from us, it appeared to be of the twelfth magnitude in spite of the very favorable conditions. If in opposition, at its average distance from the Sun, it would be more than one hundred times fainter, and of magnitude [illegible], hardly visible with the great Yerkes telescope, and just accessible photographically with the most powerful instruments, if its apparent motion were not so rapid. When remotest from the Sun, its magnitude, even if the Earth was most favorably placed, would be [illegible] so faint that, even if fixed in the heavens, it could be photographed only with the great Mount Wilson reflector; and, considering its motion, would be beyond even its powers.

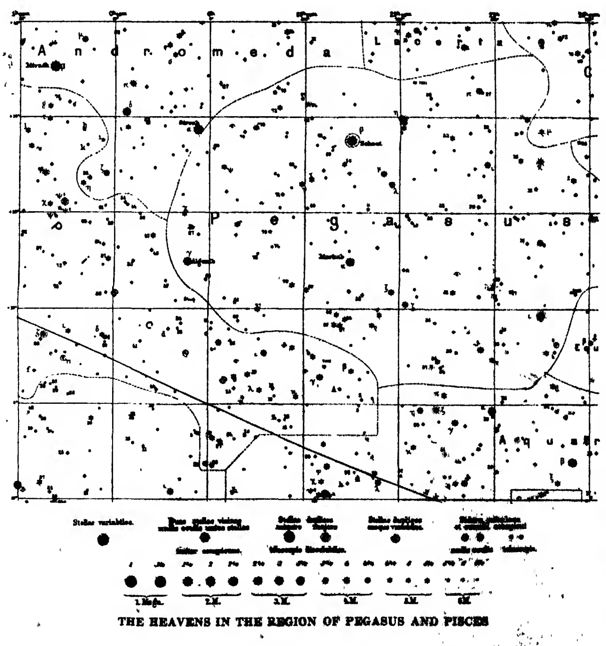
It can probably be observed only when in the nearest third of its orbit to the Sun, and then only while the Earth happens to be on the same side of the Sun as the planet. According to Mr. Haynes' calculations, it should return to its perihelion in October, 1915; but observations covering only two weeks give but a slender basis for prediction of a planet's place four years ahead, and it may be necessary to keep a sharp lookout (photographically) on the planet's track for months around this date.

The actual diameter of the new planet can only be estimated by comparing the amount of light which it reflects with that which we would receive from Mars or Mercury at the same distance; and in this way it may be estimated that it is only three or four miles in diameter, a mere speck compared with the extent of interplanetary space.

The curious name of this little body deserves explanation. When the discoveries of asteroids became numerous, fifteen years or so ago, they were provisionally denoted by letters, *A*, *B*, *C*, etc., the assignment of names and of permanent numbers being reserved until reliable orbits could be calculated. The alphabet was soon exhausted; then pairs of letters were used—*AA*, *AB*, to *AZ*, *BA*, *BB*, etc. Two or three years ago this arrangement ran out; and then it was decided to begin again with *AA*, but to prefix the date of discovery. Hence, the present planet is called 1911 *MT* to distinguish it from one with similar letters in the earlier sequence, discovered some years ago. It will probably not be long before it receives a permanent number and a name.

The principal astronomical event of the coming month will be the total eclipse of the Sun on October 10th, which is visible in a small part of the southeastern United States as a partial eclipse just after sunrise. The track of total obscuration begins in the Pacific, off the coast of Nicaragua, crosses South America from one point in Ecuador a little north of Quito to one in Brazil a little south and west of Rio de Janeiro, after which the whole course is lost in the South Atlantic. The greatest observable duration of totality is about 1 minute 50 seconds, on the Brazilian coast. It is to be hoped that weather conditions may favor the observers of this eclipse better than they did last year in the Tonga Islands, when clouds almost completely

(Concluded on page [illegible].)

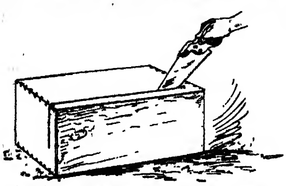


THE HEAVENS IN THE REGION OF PEGASUS AND PISCES

Making a Tool Chest

By R. F. Albert

IF you desire a chest or box with a trunk or recess cover, you can make the best job by putting your box together and fastening up the sides and ends, top and bottom, by dovetailing or otherwise. With a gage you make a line parallel to the top edge and far enough



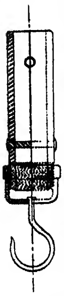
Simple method of constructing a tool chest.

down the sides to provide a lid or cover of desired depth. The box is then sawed along this line with a rip-saw. This will cut fairly smooth, and a very slight finish along the sawed edge is sufficient to complete the work. If your saw cuts smoothly, merely sandpapering will do in some cases, and you will find the cover to be a nice fit.

Rope-end Hook

By Freeman Weiss

IN making a porch swing recently, the writer had occasion to find a suitable method of attaching the ropes to eyes in the ceiling, something a little neater than the customary bulky knot or loop, and yet able to stand considerable strain. The market provides a "rope-end clip," which is, however, made no larger than ¾ inch in diameter. As in the writer's case, where a larger rope must be used, the following will be found entirely secure, and of very neat appearance:



Rope-end hook.

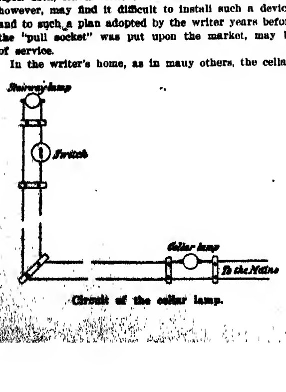
A piece of 1-inch iron pipe (larger or smaller according to the size of the rope) about 5 inches long is cut off and threaded on one end. Two ¼-inch holes are drilled on diameters of this piece, at right angles to each other and about an inch from the ends. For these, two pins are made, long enough to reach through the pipe and allow for riveting over at each end. A standard pipe cap to match the pipe is then drilled through the center to a trifle larger size than the shank of the screw hook or eye, permitting it when in place to turn freely. The hook or eye, as the case may require, is then cut off just above the threaded portion, and is fastened into the cap by riveting over the shank. The cap may be screwed on and the rope inserted in the pipe and fastened there by means of the two pins, which are then riveted over. The accompanying illustration, showing a partial section of the completed hook, will make the construction clear. A valuable feature of this device is the swiveled hook, which prevents twisting of the rope. This hook has been tested to over five hundred pounds pull and found quite secure.

Improved Arrangement of Cellar Lamp

By Thomas T. McNish, M.D.

THE ingenious automatic cellar switch described by Mr. J. E. Hanning in the SCIENTIFIC AMERICAN of April 13th, leaves little to be desired. Some readers, however, may find it difficult to install such a device, and to such a plan adopted by the writer years before the "pull socket" was put upon the market, may be of service.

In the writer's home, as in many others, the cellar-way leads from the kitchen down to a landing, and then behind a partition which shuts off all light from the cellar. At the head of the stairway is a lamp, and below it a switch, which formerly was used only to throw in the furnace cellar lamp, the upper one being turned on or off independently. With this arrangement, the cellar lamp was frequently left burning, and that suggested the simple expedient of joining the two lamps in the same circuit. As this circuit carries 105 volts, each lamp is 52 volts. This combination, which is shown in the accompanying sketch, has been entirely satisfactory, as the light from the upper lamp cannot be overlooked.



Circuit of the cellar lamp.

Home-made Oil Filters

By Frederick E. Ward

IN the home workshop, and especially where there is an automobile to be taken care of, much valuable lubricating oil has to be thrown away when it becomes too dirty or gummy for further use, and yet the quantity is not sufficient to warrant the purchase of an oil filter. Practically all of this wasted oil could be saved and made as good as new by the use of an inexpensive home-made filter, such as is shown in the accompanying photograph.

A 6 by 8-inch glass battery jar, or other suitable vessel, is provided with a wooden cover having a large circular opening in the middle. Into this opening is fitted a cone made of wire gauze or mosquito netting, held in place by a few carpet tacks. When placed over the jar, this serves as a support for the paper filter cone, one of which is shown lying on the table, and which, for ordinary grades of machine oil, is best made up of two thicknesses of ordinary light brown Manila wrapping paper, folded carefully so as to avoid tearing. After the dirty oil is placed in the paper cone,

A home-made oil filter.

it takes some little time for the filtered oil to begin to drip through, but it will be found that if the apparatus is left to itself for a few days, a surprising amount of clear, pure oil will accumulate in the glass jar. By the use of paper of a suitable texture, even the hopelessly black and gritty oil wrung out from the waste with which engine drip pans are mopped up, may thus be purified for further usefulness.

Workshop Notes

How to Make an Old File Cut Like New.—When a file has seen its best days and refuses to cut, try this little kink: Take a piece of charcoal and rub on the file, just one or two strokes, and then try your file. You will find that it cuts much better, and will not clog with filings.—H. D. C.

Making Small Taps.—One of the small but irritating accidents to which a mechanic is often subject is the breaking of small taps. In a large machine shop duplicates are generally at hand, but the home mechanic is not always so fortunate. A temporary and fairly efficient substitute, however, may be made from an ordinary fluted drill of the proper size. The drill should first be annealed, then tapered with a file, threaded with a die of the desired size, and finally restored to its original temper.—STUART R. WARD.

Converting Centigrade into Fahrenheit

IN the SCIENTIFIC AMERICAN of September 14th we published an article entitled "How to Correct a Thermometer." In this article formulas were given for converting Centigrade to Fahrenheit and Fahrenheit to Centigrade. The former formula was incorrectly stated. It should have been $F = \frac{9}{5}C + 32$.

Guideline Creaser

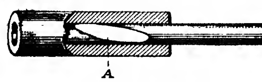
SEVERAL suggestions have been published in these columns for making guidelines for lettering drawings. In the writer's opinion it is not necessary actually to draw the line. Instead, the tool illustrated herewith may be used. Cut it out of sheet brass, copper,

Guideline creaser.

or tin to the shape indicated, the distance between the points being the distance wanted between the lines. With this tool the drawing is merely creased or faintly pressed, so that after the letters have been made there are no lines to be erased.—B. F. DASHIELL.

A Simple Reamer

THIS reamer is made by taking a perfectly round piece of steel and beveling the end as shown, making as sharp a corner as possible, marked A. It can be



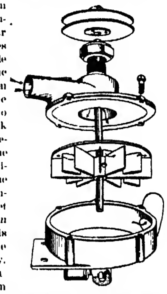
Simple form of reamer.

backed off a little on the round side, starting a little from the edge marked A. Then it may be tempered in the usual manner.—A. F. B.

Circulating Pump for Gasoline Engines

By A. F. Bishop

THE pump shown in the accompanying engraving is adapted for use on gasoline engines either of the automobile type or of the marine type. The construction shown represents the work of an amateur who has fortunately struck upon a very efficient design. The pump is of the centrifugal type, as indicated by the arrow. The shaft is ⅝ inch in diameter and the bucket wheel 3¼ inches in diameter. The shell is bored out to allow the wheel to revolve freely. The design of the machine is clearly shown in the illustration, and the parts are drawn in proper proportion, so that it should be a simple matter for others to copy the construction.



Home-made circulating pump.

Electric Speed Indicator

By B. F. Dashiell

A SIMPLE speed indicator may be made by anyone as follows. On a suitable base mount two gear wheels, B and D. The wheel B should have 100 teeth, and D should have 110. The latter should mesh with a pinion C having ten teeth and soldered to the wheel B. On the periphery of wheel D solder a pin to form a contact point adapted to engage a spring contact at each complete turn of the wheel. In this way an electric circuit is closed through a sounder and battery arranged as indicated in the diagram. In use, a small pinion A, provided with ten teeth, should be fitted on the shaft whose speed is to be determined. The instrument is then brought close to the shaft, so that the pinion A will mesh with the gear wheel B. The speed of the shaft in revolutions per minute may then be determined by counting the number of clicks in the sounder and multiplying by $\frac{B}{A} \times \frac{D}{C}$ or 110; for pinion A will have to turn ten times before the gear wheel B will make one complete revolution, and the gear wheel B with its pinion C will have to turn eleven times while the gear D is making one complete revolution.

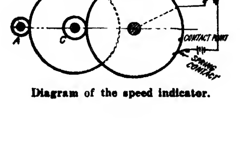


Diagram of the speed indicator.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Self-contained Diving Outfit

By Our Berlin Correspondent

THE diving outfit designed by Messrs. Drägerwerk of Lübeck, Germany, makes the diver independent of atmospheric air, by supplying him with oxygen and regenerating the air he expires. The outfit comprises an apparatus worn like a knapsack where the air circulating in the helmet and the diving suit is purified automatically of the deleterious gases produced by breathing and regenerated by an addition of oxygen. The diver thus has at his disposal 60 to 70 liters of air per minute, i. e., 3,600 to 4,200 liters per hour, which suffices for even the most exacting work.

The regenerating apparatus comprises steel cylinders filled with compressed oxygen, a potash cartridge and circulating arrangement, viz., a suction and pressure nozzle and a pressure reduction valve. It is connected with the helmet by two short lengths of hose, one of which serves to draw off any used-up air, while the other supplies fresh air.

The apparatus is started up by opening a valve which is very easily handled; it will work from 2 to 3 hours, in accordance with the personal skill of the diver and with the quantity of carbonic acid secreted by his lungs.

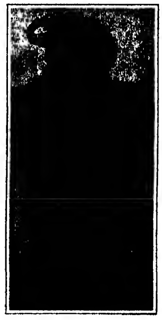
In the place of the usual lead ballast, the diver carries on his chest a weight constituted by steel bottles where compressed air or highly compressed oxygen is accumulated. Whenever the diver wishes to reach the surface without any outside help, he simply opens the valve of these bottles, thus causing air to flow into his outfit and to impart to the latter the required buoyancy. This is how in cases of emergency he will from any normal depth reach, in a few moments, the surface of the water. A safety valve actuated with any excess pressure prevents the diving outfit from bursting with any accidental rise from considerable depths. If on the other hand the diver happened to fall even to a small depth, his life would be seriously endangered unless some special safety device were provided. In fact, any sudden increase in pressure would throw the diver's body into the helmet, like the piston of an engine, while the congestion produced at the same time might cause the man to swoon, so as to be unable to prevent a catastrophe. In order to obviate this danger, the helmet of the new diving outfit has been made of a subtle and substantial India rubber fabric, protected by a metal cover against any mechanical injury. Should the diver happen to fall, the pressure of the water would compress not only the air in the outfit, but the air in the helmet, the India rubber fabric of which will yield in the same way as that of the outfit. While the diver thus would feel the sudden increase in pressure, he would experience it uniformly on all sides, which would first of all prevent congestion. He will thus be able, with full consciousness, to allow some air to enter his outfit from the ballast on his chest, thus re-establishing normal conditions at a moment's notice. A safety acting telephone, which on account of the feeble noise of the air circulating in the apparatus insures a very satisfactory connection, can be attached to the helmet. The telephone cable and signaling string can be combined in a safety cable for hauling the diver to the surface in cases of emergency.

The type of apparatus so far designed is destined for depths of 20 meters as a maximum. Apparatus allowing the diver to work at greater depths are in course of preparation.

The carbonic acid expired by the diver is absorbed in the potash cartridge attached to the knapsack apparatus where the air passes in succession some flat cups lined with numerous grains of potash and soda which absorb any trace of carbonic acid. The air thus freed from any deleterious gases produced by breathing reaches the suction and pressure valve, in order there to be regenerated with a supply of 2 liters of oxygen per minute. The air conduit supplying the fresh air to the mouth and nose of the diver, closes the cycle performed by air circulation. The diving outfit acts, both as a breathing bag and an air reservoir in critical moments.

A special feature of this apparatus is its allowing the diver to work for hours below the surface without any connection with the land or ship, whenever the safety string has been cut or the telephone connection interrupted. Any pumps and the men required for their operation are dispensed with, the diver carrying about with him the air supply required for his breathing. Moreover, there is no risk of the diving outfit becoming twisted with the air conduit; and the cost of operation is extremely low.

Diver coming to the surface of his own accord.



A self-contained diving apparatus ready for use.

The Raliophone

By P. F. Mottelay

HANS VON KRAMER, an electrical engineer of Birmingham, has invented a system of wireless railway, telegraphy, telephony and train signalling, of which several successful public demonstrations have been made. The apparatus is called "The Raliophone," and operates by electro-magnetic induction between coils placed on the train and a copper wire or cable supported on short posts or, preferably, buried under ground, parallel with and outside of the track.

For use in telephoning between the station and the moving train the train equipment comprises a telephone transmitter and a pair of head telephones placed in a sound-proof box in the guard's compartment of a coach. These instruments are electrically connected with two large coils of copper wire wound on frames called "Raliophone Frames," which are suspended from the coach by iron brackets. The upper frame is suitably wound for sending and the lower for receiving.

The telephonic currents produced by the voice create a fluctuating magnetic field which emanating from the upper frame, induces an electric current of corresponding period in the underground wire, which is connected to telephones at stations and, if desired, may be connected with the general telephone and telegraph system. There is no mechanical contact between the buried wire and the moving train. Conversely, telephonic currents sent through the buried wire from instruments at stations induce corresponding currents in the lower raliophone coils, which are connected with the receiving instrument on the train.

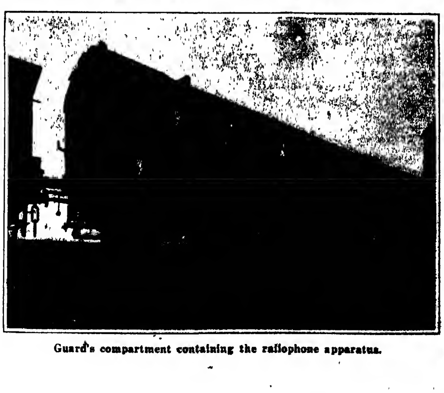
In the original system there were no means of "calling up" and the operator, like a wireless operator aboard ship, had to be in constant attendance. This defect has been remedied by the addition of a very sensitive detector, which picks up the exceedingly feeble electrical impulses received on the train by induction and "relays" them into currents strong enough to ring a bell or sound a horn.

For telegraphing it is merely necessary to connect the wires by suitable switches with the telegraphic instruments, instead of the telephones. With the telegraphic instruments signals can be transmitted by the Morse key and code.

For railway signalling the resonating relay or detector already mentioned is employed. This instrument, the invention of Dr. Kapp and Mr. von Kramer, possesses several unique features, including its extreme sensitiveness and facility of tuning to different frequencies. It has no movable parts, requires no adjustments whatever, is unaffected by mechanical vibrations of frequencies differing from its own and is of very simple construction. It is so sensitive that it can be operated by 1/8 volt and 1/4,000 ampere. It consists of a magnetic system acting on a tuned steel reed, one end of which is rigidly attached to one pole of a powerful permanent magnet, while the other end is free to vibrate between the two parts into which the other pole is divided. The feeble alternating current which is received by induction, passes through two coils which act together upon the free end of the reed. When the frequency of these currents corresponds with the natural period of the reed, the latter is set into vibration

Solenoid controlling the brakes.

Telephoning from a moving train.



Guard's compartment containing the raliophone apparatus.

caused to open or close a local . With this relay, which is un- d by outside disturbances, whether al or mechanical, such as vibra- due to vehicles, it is possible to ring sound steam whistles or automo- orns, operate locomotive valves, sig- levers, interlocking gear, vacuum s and signal lamps. The detector even been successfully adapted for matic stopping of trains.

ch section of track between two con- ive signal stations is divided into distinct parts: The Main Section, 1 mile to 10 miles or more in length; estoring Section, and the Clearing n, each about 100 yards long.

following results have been ob- with the apparatus: When a train the Main Section, a red lamp is lit e signal station. This lamp is placed the signal controlling the semaphore. red lamp remains lighted until the n has passed through the Main Sec- and the Restoring Section beyond. ultaneously with the lighting of the p, a bell, or buzzer, is sounded, as an ditional warning to the signalman to tect the section by displaying the nger signal. If he does not obey the rning within ten seconds, the signal er is automatically operated, and its vement is recorded. The signal lever, whether moved automatically or by the operator, remains electrically locked in the danger position until the train has left the section. If the lever is operated automatically an alarm gong outside the signal box is sounded and the time of the occurrence is automatically recorded, so that a strict control is kept over the signalman. When the train enters the Clearing Section, the red lamp is automatically extinguished and a green lamp is lit. When the train leaves the Clearing Section, the green lamp is extinguished and the signal lever is unlocked. After the train has sent out signals indicating its entrance into the Main Section, it is enabled to receive signals or instructions by telephone or telegraph. It can be brought to a standstill by the signalman at will, or the conductor can place himself in communication with the signal section.

If a second train ignores the danger signal and enters the section, both trains are automatically stopped. Should a second train enter the section in the opposite direction, the same result ensues, so that head-on collisions are impossible. When the train has left the Clearing Section, the instruments at the station are restored to their normal condition, but should the train be prevented from entering the succeeding Main Section, the green lamp continues to glow, and the alarm gong to sound. For signaling in foggy weather a special fog signaling attachment is added to the train equipment by which the train is automatically stopped in each Clearing Section.

The essential features of the Railophone may be summed up as follows: The transmission of signals is effected by induction from wires which are safeguarded from accident by being placed underground, and thus a reliable connecting link between stations and trains is established throughout the whole journey. The signals are unidirectional and cannot stray to other trains, as may occur with ordinary wireless signals. The system requires no sliding brushes, contact bars or switches, bonded rail joints, or any obstruction of the track, and it is not influenced by atmospheric disturbances or climatic conditions. The cost of maintenance of the underground circuit is trifling and the initial cost per train mile is exceedingly small.

The system comprises five principal groups of apparatus: First, the stationary underground conductors; second, the movable circuits carried by one coach of each train; third, the tunable detector employed as a relay; fourth, the alternating current apparatus, telegraph and telephone instruments; fifth, the solenoids which automatically operate the alarm signals and controlling gear.

The adoption of the system does not entail any essential change in regulations. In ordinary conditions the operator at the signal station has no additional apparatus to attend to, but is merely required to observe the audible and visible signals. As the engine does not carry any railophone apparatus the attention of the driver is not diverted from his engine. All the apparatus on the train is mounted on one coach, and trains can be made up and engines coupled in the ordinary way. Instead of encouraging carelessness of the drivers and signalmen, as an entirely automatic system of controlling trains might do, the railophone system increases their alertness by automatically recording any inattention. By this means it is probable that a large proportion of the very numerous slight accidents which are just prevented from becoming serious will be avoided.

In a recent demonstration of the apparatus messages were sent from a moving train to a station and from the station to the train, the moving train was warned by audible signals, stopped automatically, and also by the station operator, and was prevented from entering a block until the brake had been released by the operator at the signal station.

Notes for Inventors

Making Paper from Redwood Bark.—The bark of the California redwood tree, which has heretofore been practically a waste product of the many large lumber mills of the State, is likely to be used to a large extent in the manufacture of paper. Heretofore redwood lumber mills have been unable to dispose of the bark to paper manufacturers for the reason that there seems to be no way of removing the red color. Recently, however, a process has been discovered by which the color can be removed or changed, so that white paper may be made of the redwood bark. A company has been organized to manufacture paper from the redwood bark and is purchasing the waste material from the big mills in the forest regions of Mendocino County, California.

Dentists as Inventors.—You are pretty sure to find an inventor if you scratch a dentist, for, under the skin, practically all of the profession exercise the creative art. This is not to be wondered at because of the intelligence of the dental doctors and the fact that operative and mechanical dentistry both call for a high degree of mechanical ability; the combination of intelligence and mechanical ability and their exercise being sure to result in invention. That many inventors are found among the dentists accounts, in part at least, for the high development of the science especially in this country. Considering all of this, it is strange that no one has yet, so we are told, provided a plastic filling that will permanently resist the action of the fluids of the mouth. Such a filling would probably mark the greatest advance made for years in the dental art.

Life-saving Appliances.—The Board appointed by the War Department with Lieut.-Col. Chauncey B. Baker, Deputy Quartermaster-General U. S. Army, as its president, to consider the question of installing additional and suitable life-saving equipment on army transports in compliance with Act of Congress approved June 14th, 1912, has arranged for a meeting of the Board to be held at Newport News, Va., about the week commencing October 7th, 1912, the exact date of which meeting can be ascertained later by addressing Geo. A. Anthony, secretary of the Board, office of the Quartermaster-General, Washington, D. C. It is the purpose of the Board to consider at this meeting any life-saving apparatus, including lifeboats, launches, rafts or other devices, launching apparatus, or whatever gear or appliance that may be necessary for the efficient handling and operation of the same; and those interested are invited to be present at that time prepared to demonstrate the utility and efficacy of any device they may have to present.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

HAT FASTENER.—H. DIPPEL, 611 Texas St., San Francisco, Cal The inventor's object is the provision of a simple, economical, and easily operated device for securing a hat in place on the head of the wearer, which will hold the hat securely in place, while permitting its easy removal when desired

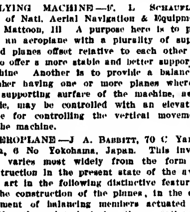
BANDEAU AND HAT FASTENER.—CORINNE E. THORNTON and MARIE THORNTON, care of Dr. J. Thornton, 606 Exchange Bldg Los Angeles, Cal The object of this improvement is to provide a simple and cheaply constructed device especially designed for holding ladies' hats in place, without injury to the hat or to the wearer, or to others, which may be easily applied or removed

Pertaining to Aviation.

AEROPLANE.—S S. YARRINGTON, 2510 W. 18th St, Wilmington, Del. An object here is to provide a pair of operating levers, each pair of said levers having double functions, thereby reducing the necessary number of operating levers The hydroplanes are provided with means connected with a lever for lowering and raising the same. The invention provides a form of elevating plane and means for manipulation; also a form of rudder with means for supporting the same and operating it.

FLYING MACHINE.—C. L SCHAUFLER, care of Natl. Aerial Navigation & Equipment Co, Mattoon, Ill A purpose here is to provide an aeroplane with a plurality of superposed planes offset relative to each other so as to offer a more stable and better supported machine Another is to provide a balancing member having one or more planes whereby the supporting surface of the machine, as a whole, may be controlled with an elevating plane for controlling the vertical movement of the machine.

AEROPLANE.—J A. BABBITT, 70 C Yamashita, 6 No Yokohama, Japan. This invention varies most widely from the form of construction in the present state of the aviation art in the following distinctive features in the construction of the planes, in the employment of balancing members actuated by shifting the aviator's body, the operation of the steering rudder by means of the feet,



AEROPLANE

and the mechanical means whereby this is accomplished, the manipulation of levitating and balancing planes and the simplified mechanism whereby the same is accomplished, and the construction and employment of self-contained earth traction driving wheels which may be discontinued immediately the aeroplane is lifted from the ground The machine is herewith shown in a perspective view

Of Interest to Farmers.

EXHAUST FAN.—S. REMBERT, 1138 Poplar St, Memphis, Tenn This improvement is particularly in that class of exhaust fans illustrated in a former patent granted to Mr Rembert, the present invention seeking to provide a construction by which the seed cotton or similar material handled by the fan may be discharged separately from the dust-laden air drawn in by the fan, thus enabling the discharge of the seed cotton and dust-laden air at different points and separately

PLANTER ATTACHMENT FOR CULTIVATORS.—J P BRADFORD, R F. D. No 2, Jasper, Mo. The intention here is to provide an attachment for connecting the grain or seed box of the planter with the axle, to permit of a variety of adjustments of the box with respect to the planter, which may be applied to existing planters with but slight changes

STONE CATCHER FOR FLUMES.—H. R. VAN EYCK, 179 E. 8th St, Holland, Mich. The invention refers particularly to flumes for conveying sugar beets to the mill. An object is to provide a means for catching the stones or other foreign matter, and to so arrange the device that the stones, etc., may be cleaned from the flume without interfering with the flow of the beets for any material period.

Of General Interest.

BUILDING LIGHT AND VENTILATOR.—P. SCHWICKART, 118 Broadway, N. Y., N. Y. This invention relates to skylight and similar building lights, and its object is to provide a light and ventilator, arranged to insure a proper illumination of the space below by the use of reflected rays of light, and to provide a thorough ventilation of the said space

COLLAPSIBLE BARREL.—J W SUTHERLAND, 48 Dorchester St, Sydney, Nova Scotia, Canada By means of this invention a number of barrel staves can be adjustably secured together, side by side, by means of flexible hoops, together with an arrangement for uniting the ends of said hoops and fastening the ends to hold the barrel staves with their longitudinal edges in contact, so as to form the body of the barrel and hold firmly in place the heads of the barrel at opposite ends of said staves, when the barrel is to be made ready for use

STUD FOR USE IN BUILDING CONSTRUCTION.—D DOWD, 402½ E 5th St, Los Angeles, Cal This inventor's purpose is to provide a stud which can be readily stamped and worked out of thin metal to special forms and shapes which is light in weight and provided with simple means whereby lath or other suitable material may be easily attached to the same

Hardware and Tools.

WINDOW LOCK.—G. B ROBERTS, 170 E 77th St, Manhattan, N Y, N Y., and M T FLANAGAN, North Tarrytown, N Y. This invention pertains to windows having up and down sliding sashes, and provides a mechanism by which the sashes may be readily and securely locked by a single operation For this purpose use is made of a locking device on a window frame, and having transverse bolts adapted to register with keepers in the sash stiles at the time when the latter are properly positioned to receive said bolts.

BURR FOR DRESSING GRINDING STONES.—T E WARREN, care of Ticonderoga Mach. Wks., Ticonderoga, N Y. This invention relates to means for burring wood pulp grinders, and provides a burr for dressing, roughing or, as usually termed in mill practice sharpening or burring grinding stones, and arranged to provide a clearance for the dust or small particles removed from the peripheral face of the grinding stone, and to render the teeth of the burr strong and durable

UNIVERSAL CLUTCH.—J CARL, 65 High St, College Point, L I, N Y This invention comprehends a clutch having a body portion and a number of swinging bails or jaws removable relatively to one another, and so formed as to grip the article to be supported, the weight of the article aiding materially in the gripping action

Heating and Lighting.

SAFETY GAS VALVE.—H R COX, 91 Center St, New York, N Y, and W SCHMIDT, New York, N. Y More particularly this invention comprehends a self-closing valve containing a valve seat and a valve member movable against the seat, together with means for exerting leverage upon the valve member as the same is pressed against its seat

FILTER.—C B. HOUSER, JR., 700 State St, E St Louis, Mo The inventor's principal purpose is to provide a hot air filter which may be applied to a register, the application and use of the filter not necessitating the removal of the register or any change in the construction thereof, the device being particularly adapted to be positioned on top of the register

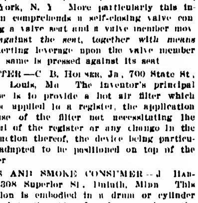
GAS AND SMOKE CONSUMER.—J HARMON, 308 Superior St, Duluth, Minn This invention is embodied in a drum or cylinder attached to the side of a furnace above the grate and provided with a pivoted damper for controlling the draft and with a partition or false bottom which is spaced from the true bottom of the drum to form a passage way for admission of air through the apertured front end of the partition

Household Utilities.

FOLDING BED.—L B JEFFCOTT, 250 W 15th St, Manhattan, N Y N Y For the purpose of this invention, the mattress frame is made in sections, of which the head and foot sections are U shaped and the middle or intermediate section is formed of side bars pivotally connected with the side bars of the head and foot sections, and pivotal connections are provided between these sections and the head and foot of the bed

Machines and Mechanical Devices.

ELEVATOR INDICATOR.—F A BOEDTCHER, Bergenfield N J In carrying out the objects of this invention, a side view of which



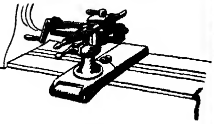
ELEVATOR INDICATOR

is pictured in the accompanying engraving, an indicator is provided which is formed with the usual pointer and the usual supporting

axle therefor. Rigidly connected with this axle is a grooved wheel designed to carry a substantially U-shaped bar arranged to be driven back and forth over a pulley, whereby the pulley is rotated. This reciprocating bar is connected with a pivotally mounted lever which in turn is connected by a suitable cable to the usual indicator rod or cable.

TANNING DRUM.—C. HASS, Strassburg, Alsace-Lorraine, Germany. This invention refers to revoluble drums provided with trunnions on the drum heads. The object is to provide a tanning drum arranged to relieve the heads of the drum of all undue strain and to transfer the strain directly from the rim of the drum to the trunnions.

SLIDE REST.—G. R. KACSMARIK, 588 E. 82nd St., Manhattan, N. Y., N. Y. For the purposes of this invention use is made of a spindle mounted to turn in the tool post and provided with a horizontally-disposed guideway on which is mounted to slide a head for carrying the tool, the said head being engaged



SLIDE REST.

by a screw rod journaled on the guideway. Use is made of a tool-adjusting screw rod screwing in the head and arranged parallel to the tool, the said tool-adjusting screw rod being provided with a collar engaging a recess in the tool for shifting the last in the direction of its length on screwing the said tool-adjusting screw rod inward or outward in the head. The engraving shows a perspective view of the slide rest in position on a lathe used by jewelers and other persons.

MACHINE FOR PICKING PIN FEATHERS FROM FOWLS.—C. W. SMITH, care of Swift & Co., Stockyards Station, Fort Worth, Texas. This improvement has reference to devices for picking pin feathers from fowls, more particularly for picking pin feather from poultry. The pin feather may be removed in much less time than in the ordinary manual operation, and without injury to the fowl.

TAMPING MACHINE.—O. NOLAN, 1492 Sherburn Ave., St. Paul, Minn. The object of this invention is to provide a machine for tamping quickly and firmly concrete into molds, wherein a plurality of tamping devices or stamps is made use of, operating in succession by manual means or by power and having means for holding the stamps in inoperative position.

FLY AND MOSQUITO DESTROYER.—J. T. PLUMER, Salt Lick, Ky. The principal object which the present invention has in view is the provision of a mechanical device to rapidly rotate invisible whip-like members across a passage to strike and so destroy flies, mosquitoes or other winged insects when in flight.

WHEEL RIM JOINTING MACHINE.—G. A. ENSIGN, care of Defiance Mach. Works, Defiance, Ohio. The invention provides a machine designed for jointing or truing one side of the wheel rim stock to render the said side true with the inner surface of the stock so that any inequalities due to bending or shrinkage are compensated for and the stock is provided with a true working surface to permit of subsequently feeding the stock correctly through a planer to insure the perfect formation of perfect wheel rims.

WEAVE.—J. C. GAYNOR, 465 E. 31st St., Paterson, N. J. This invention pertains particularly to weaves designed to permit sections of the cloth woven to be cut without presenting an edge which will ravel. The object is to provide a weave arranged at any angle across a given piece of cloth, which will permit the cloth to be cut without presenting a raveled edge.

TENSION DEVICE FOR BAND SAWS.—G. A. ENSIGN, care of assignor to Defiance Mach. Wks., Defiance, Ohio. The object here is to provide a new and improved tension device for band-saws arranged to maintain a uniform tension on the saw blade to permit light or heavy sawing of hard or soft wood without danger of breaking the saw blade or running the same off the wheels.

DUST RECEPTACLE.—T. E. MITCHELL, Box 99, Meaderville, Butte, Mont. The principal object of this invention is to provide a receptacle adapted to be positioned adjacent a hole which is being drilled whereby the dust and other material being set free by the drill will be collected, thereby preventing it from circulating in the atmosphere.

MACHINE FOR REMOVING PULP FROM COFFEE BERRIES.—J. M. URGELLES, Baracoa, Cuba. The object of the invention is to provide a new and improved machine for removing the pulp from coffee berries in a very simple, effective and economical manner and without injury to the beans. Means provide for removing the pulp and embedding means from the berries and discharge the latter separately from the removed pulp and material.

METHOD FOR TREATING COFFEE BERRIES.—J. M. URGELLES, Baracoa, Cuba. This method consists essentially in embedding sand, sawdust or other abraiding material in the pulp of the berry, than subjecting the berry to a grinding, tumbling and brushing action to cause the abraiding material to loosen and detach the pulp from the berry, and finally separating the berry from the removed pulp and braiding material.

BOTTLE CLOSING DEVICE.—F. BAGAR, Vienna, Austria, care of B. Zechner, Inwald Glass Co., 25 West Broadway, N. Y., N. Y. This improvement relates to a device for securing closing caps on bottles and other vessels and an object of the invention is to provide a machine which will rapidly and firmly press the flange of the cap outward into engagement with an internal groove within the mouth of the bottle or other vessel.

Prime Movers and Their Accessories.

DEVICE FOR STARTING INTERNAL COMBUSTION ENGINES.—D. E. CROUSE, 8 North St., Annapolis, Md. This device will start an internal combustion engine through the medium of compressed air. A movable rack engages a pinion on the shaft of the engine, the movement of the rack into engagement with the pinion being accomplished by means of compressed air, and the return of the rack to its initial position being effected by means of a spring.

THRUST BEARING.—E. KASNER, care of Tampa Foundry & Machine Co., Tampa, Fla. This invention has reference more particularly to a thrust bearing which comprises a removable collar adapted to receive a shaft, and having at the end an annular recess, about the shaft, and bearing washers located in the recess and adapted to receive end thrust from an adjacent machine part.

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.—R. H. MUNTZ, care of Geissler Starting Device Co., 514 W. 57th St., New York, N. Y. In this case the invention refers to a device for starting an explosive or internal combustion engine without the necessity of cranking up; that is to say, the operator can start the engine, if it should happen to be attached to an automobile, while sitting in the operator's seat.

EXPLOSIVE ENGINE.—W. A. SCHAFFER, Schaffer & Orand, Box 299, Waco, Tex. This invention has in view a two-cycle explosive engine in which the cylinders are thoroughly cleared of the burnt gases after each explosion, preparatory to introducing the succeeding charge, whereby there is little opportunity for the engine to back-fire.

VALVE FOR ROTARY GAS ENGINES.—W. S. THOMPSON, care of Ga. Ry. & Electric Co., Smyrna, Ga. This invention relates to a valve construction for rotary gas engines designed to facilitate the storing of the combustible mixture under pressure in the firing chamber before ignition, and the release of the same therefrom after ignition, to apply the power of the burning gases to produce rotary motion of the moving parts.

ROTARY ENGINE.—H. LINDENBERG, 817 Smith St., West Hoboken, N. J. This invention has reference more particularly to an engine which comprises a stator, a rotor provided with a piston movable into an operative and an inoperative position, and means whereby said piston when in an operative position is partly balanced by live steam or other fluids under pressure.

Railways and Their Accessories.

DECK SASH AND TRANSOM.—T. W. COTTLE, 382 Green St., Topeka, Kan. This invention provides a transom which may be used in railway cars and which may be opened or closed by a single movement and when closed will be positively locked in position. The sash may be opened to permit ventilation and may be held in open position by a simple and inexpensive means.

BRAKE RIGGING.—J. S. WATHEY, care of Butte Elec. Railway Co., Butte, Mont. This invention relates particularly to brake rigging, and the aim is to provide a car truck with a brake rigging, wherein the rods may pass over and below the motors, by virtue of a diagonally-disposed equalizing lever, to apply the brakes simultaneously to all the wheels.

RAILWAY TIE.—G. NAYLOR, 1271 So. 9th St., East St., Salt Lake City, Utah. An object here is to provide a form of rail-engaging device that will hold the rail firmly while permitting expansion and contraction, and by reason of which the use of fish plates may be done away with if desired. Rail-engaging means have securing bolts so related to the other elements entering into the tie that they will not be readily accessible to unauthorized persons seeking to tamper therewith.

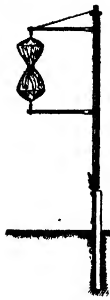
AUTOMATIC TRAIN CONTROLLING SYSTEM.—F. D. SHINDEL, Huntingdon, Pa. Mr. Shindel's invention relates to automatic car controlling systems, and embodies more particularly an electrically operated system of this general type, so arranged as to automatically stop any car attempting to enter a block already occupied by another car.

COMBINED RAIL FASTENER AND TIE.—E. YOUNG, Princeton, Ky. This inventor provides an improved structure formed of metal and arranged to thoroughly clamp and brace the rail in position. He also provides a tie and fastener formed with rail engaging members and braces and a tie structure for supporting the same, formed with a substan-

COMBINED RAIL FASTENER AND TIE.

tially U-shaped bar in cross section and a plate having raised members designed to accommodate securing bolts for holding the bracing members correctly in position. An enlarged transverse sectional view through a rail and combined fastener and tie is shown in the engraving.

MAIL CRANE.—J. M. HOUGH, agent for C. & N. W. Ry., Woodbine, Iowa. This invention has reference to cranes adapted to be erected at the side of a railway track and having means for so holding the mail bag as to permit the bag to be automatically taken up by a passing train, when the lower arm



MAIL CRANE.

will drop, and will strike the upper end of a trip lever, and thus a pin will be withdrawn from engagement with a pull rod, and allow the upper arm to fall. The engraving herewith presents an elevation showing the crane and its appurtances in the position of holding a mail bag.

Designs.

DESIGN FOR A LOCK JAR.—FINLAY, DICKS & CO., Ltd., Magazine, cor. Common Sts., New Orleans, La. In this ornamental design for a lock jar the main height of the structure is reached in panel elevations that have protruding edges at top and base. The cap of the jar adds to the ornamental design, the whole presenting a simple yet highly attractive article.

DESIGN FOR AN AUTOMOBILE HOOD.—F. PORSCHE, care of Oesterreichische Daimler, Motoren Gesellschaft, Wiener-Neustadt, Austria-Hungary. In this ornamental design for an automobile hood the side elevation, the plan view and the front elevation show a construction having the simple and graceful lines that picture strength and elegance.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We are prepared to render opinions as to validity or infringement of patents, or with regard to conflicts arising in trade-mark and unfair competition matters.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & CO.,
Patent Attorneys,
361 Broadway,
New York, N. Y.

Branch Office:
625 F Street, N. W.,
Washington, D. C.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9275. Wanted name and address of manufacturer of stock patterns of platen job printing presses.

Inquiry No. 9276. Wanted a household convenience and necessity which can be retailed at a profit at a price of from $1.00 to $2.00.

Inquiry No. 9277. Wanted a machine for packing dry batteries.

Inquiry No. 9278. Wanted a machine for separating crab meat from the shell.

Inquiry No. 9279. Wanted a machine for shredding asbestos board.

Inquiry No. 9280. Wanted names and addresses of manufacturers of machinery for stuffing dolls and teddy bears.

Inquiry No. 9281. Wanted to buy machinery for bleaching walnuts and ivory nuts.

Inquiry No. 9282. Wanted name and address of manufacturer of coin-controlled gasoline-dispensing tanks for automobile use.

Inquiry No. 9283. Wanted name and address of dealers in powdered Cocoa and Kola nuts in bulk.

Inquiry No. 9284. Wanted a plan for washing, screening and loading gravel for concrete purposes.

Inquiry No. 9285. Wanted factory, store, shop or bank articles to sell by canvassing at a profit of from $1.00 to $5.00.

Inquiry No. 9286. Wanted household novelties or business necessities which can be retailed at from $1 to $3.

Inquiry No. 9287. Wanted to buy a machine which will reduce cobs to meal—not a machine for shredding the cobs, but a machine that will pulverize them.

Landsman's Log

(*Concluded from page 281*)

built and thirteen either under construction or authorized, making a proportion of only about one and one third destroyers per battleship as against the four which are necessary. In the maneuvers which I was privileged to witness, a fleet of eight battleships was accompanied by nineteen destroyers, or say, less than two and one half per ship. Had there been four per ship, the intervals between the destroyers would have been less and the chances of picking up the submarines would have been proportionately increased.

The Navy Department has very wisely adopted a policy of extreme secrecy as to the maneuvers of the torpedo-boat arm of the service; and, consequently, much that I witnessed during the successful escape of the fleet from Newport to the open sea cannot be written down in this log. Suffice it to say that the operations were completely successful and bore tribute to the effectiveness of this arm of the service.

During the afternoon, in returning to harbor, our group of five destroyers went through a series of evolutions which, as viewed from the bridge of the flagship and through unfamiliar eyes, displayed the facility and accuracy with which these craft are handled by their captains. We found anchorage for the night in one of the many sheltered harbors of the Rhode Island coast; and it is nothing to the discredit of the ship's company that they congratulated themselves on the fact that for this night at least, they would lie where the waters were so quiet as to give an opportunity for undisturbed sleep.

(*To be continued.*)

A Problem in Selling Electricity

THE invention and introduction of the new, durable tungsten filament lamp, which produces between two and three times as much light with the same current consumption as the ordinary carbon filament lamp, has placed the central station industry in a peculiar position and indeed in a crisis. Thanks to the new lamp the consumer has it in his power to secure from the electric light company a much greater amount of light than formerly possible without increasing his bill for current. It might be supposed that, because the new lamps have rendered it possible to obtain twice the amount of light formerly possible for the same amount of money, the number of consumers of current would increase, and that the central station would profit thereby. As a matter of fact, the increase in users of the new tungsten lamp means a proportionately greater loss to the central station. It costs just as much to read the meter of a consumer who burns tungsten lamps as it does to read the meter of a consumer who burns carbon lamps. The investment in coal, insulation, and the like required per customer is about the same regardless of the size of wire required for his connection, but depends somewhat on the density of service or the number of connections within a given area. The bookkeeping, expense of meter repairs, and maintenance cost, are no less in one case than in the other. Hence, when the consumer demands the installation of tungsten lamps, the cost to the central station is just as great and possibly greater than it ever was before, but the income based upon the running current charge is reduced. While it is true that the lessened demand on the part of the consumer releases so much more capacity for the supply of new customers, the cost of serving these new customers is out of proportion to the additional revenue produced. The high efficiency lamp saves the central station only coal and oil—it does not diminish the fixed charges. It does make it possible to take on new customers without any increase in the central station investment, and with little increase in distribution cost, but with considerable increase in other costs which fall entirely under the heading of customer's charges.

Many electric light companies, for many

years, have been charging for electricity according to the quantity used. A customer who uses 100 units of electricity would, under their systems of charging, pay 5 times as much as the customer who uses 20 units. This seems on first thought to be a perfectly logical and fair method of selling electricity, and its appearance of fairness has made it the more difficult to show its actual inequity. A moment's consideration will make it plain that another factor must be considered in determining the cost of electric service, and this factor, when duly considered, may show that the *cost* of serving the two customers just mentioned may be relatively much greater or much less than the five to one ratio indicated by their relative consumption. This factor, so important but so little recognized in rate systems, involves the fixed service costs. Its relation to cost of service may best be illustrated by a concrete example.

Suppose that you decided to put a little electric generating plant in your basement to supply yourself and several of your neighbors with electricity, for which service you desire to charge them enough to cover your cost. You buy an electric generator, a gas engine to run it and a switchboard, and have them installed upon suitable foundations. You erect a short pole line (or else bury the wires underground in a conduit) in order to carry the electricity from your plant to your neighbors' houses. You buy one meter for each installation (your own included) and connect up to the house wiring. Before you have sold a single unit of electricity you have had to invest possibly a thousand dollars in equipment, conduit or poles, wire and meters.

Your plant is now burdened with certain fixed charges. First there is the interest on your money, then there is the amount which you must set aside each year to replace equipment as it is worn out. This depreciation allowance is very important, for if it is not recognized, after your plant has been in operation for a number of years you would find that your initial investment of $1,000 represented a lot of nearly worn-out machinery and equipment worth at the most a few hundred dollars. You must, therefore, earn more than the interest on your investment in order to come out even; otherwise it would have been better to have left your money in the bank, where at least the principal would not waste away. You next find that you have to take out insurance on the plant, and you also figure that the space it occupies on your premises is worth a little. Altogether, your calculations show that you must make about $10 a month in order to just cover the fixed investment charges outlined above.

As some of your neighbors wish to use electric irons during the day, you find you are expected to run the plant, we will say, from 6 A. M. till midnight. At the end of the first month you find your gas bill of the plant to be, we will say, $5. This represents running expense, which is distinct from the fixed expenses previously considered. Let us suppose that you find that the meters show that 125 units (kilowatt hours) have been consumed during the first month. You, therefore, divide the $15 total expense for the month ($10 fixed plus $5 running expense) showing a total cost of 12 cents a unit, and you make out the bills for the month at this rate. You discover a peculiar thing, however, in looking over the record of monthly consumption of electricity. Smith, who lives in a very small house with only 15 lamps, has used as much current as Brown who, living in a large one, has 50. You look into the cause of this and find that Smith has bought an electric iron, a small electric stove, an electric chafing dish and several other devices which he uses during the day, whereas Brown, in the big house, has used electricity for lighting only. Smith, when he receives his bill at 12 cents a unit, decides to discontinue the use of most of his devices because he cannot afford to pay so much for the electric conveniences. Therefore, next month

you find your meters show that only 80 kilowatt hours have been used, due to Smith's decreased use of service. Eighty kilowatt hours at 12 cents brings in only \$9.60; and even though your gas bill has dropped from \$5 to \$3.50 (because you have produced less current) you find that your total expense of \$13.50 has exceeded your revenue by \$3.90, and you realize that you are losing money

About this time you hear that a new kind of incandescent electric lamp has been developed that uses only one third as much electricity as the old ones in giving the same amount of light. You begin to lie awake nights wondering what will happen to your plant. You realize that if your customers all started to use the new lamps, they could light their houses better than before on only half as much current. You have visions of the demand for electricity dropping off and your revenue going with it while your expense would be reduced by only a couple of dollars saving in gas, the fixed charge, of course, being not at all reduced. Your plant is relieved of part of its load by the reduced demands and, therefore, could carry several more customers, but in order to reach them you realize that you have to spend a considerable amount in order to extend your wires and buy more meters. This would add to the burden of fixed charges your plant must carry, and even if you succeeded in selling as many units as before, you would be getting only the same revenue as you did initially when your fixed expenses were less. Any way you figure you are bound to lose unless you raise the price per unit, and this you know to be next to impossible.

At last the thought strikes you that if you could only get Smith to use his many electric devices during the day, when your plant is running with but little load, you could afford to charge him much less than 12 cents per unit for the current used in excess of that required for his lighting. You go to him and say, "Smith, you are now using about 10 units a month at 12 cents to light your house. My plant is running with but little load all day, so that the expense to me of furnishing you with current during the day for these devices is only that of the extra gas required to carry your extra load. I am willing, therefore, to sell you electricity at 5 cents a unit for all you use in excess of that required to light your house." Smith figures a minute and says, "Well, I can afford to use my electric devices at a 5-cent rate, and I will be glad to make such an arrangement with you." At the end of the month he has used 55 units instead of 10, and you bill him for 10 units at the 12-cent rate and for the extra 45 at 5 cents, making a total bill of:

10 units, at 12 cents =	\$1.20
45 units, at 5 cents =	2.25
55 units . . .	\$3.45

An average price of about 6.3 cents per unit.

Under the single rate of 12 cents per unit he would have had to pay \$6.60 and so did not use the extra current which he is willing to buy at 5 cents. The plan works so well with Smith that you go to Brown and tell about your low rate for use of current in excess of that used for lighting alone. He, too, is willing to avail himself of the convenience of many electrical devices at the low rate. You begin to see that the number of units to be used at the high rate can very properly be determined by the customer's ordinary lighting requirements, and that this in turn is determined to a great extent by the size of his house, allowance being made in all cases for certain classes of rooms which are used but very little.

In this way you develop a rate having a 12-cent or primary charge for a certain number of units, according to the size of the man's house, and for all current used in excess of this amount you charge a secondary rate of 5 cents. This form of rate may be called a multiple rate (because of the primary and secondary charges) to distinguish it from the single rate of 12 cents per unit for all energy

The Panama Canal

Issue of November 9, 1912

The time is drawing nigh when the Panama Canal will cease to be a vision and will become a reality. No engineering work in the entire history of the world is of greater magnitude. For decades statesmen and engineers have urged the digging of a waterway which would unite the Pacific with the Atlantic.

The Panama Canal is a monument to American engineering genius. To describe it adequately the SCIENTIFIC AMERICAN will devote to it the issue of November 9th—the November magazine number. How the great locks were constructed in which ocean-going steamers will swim, how a mountain was cut in two to make way for the Canal, how great steam shovels that scoop up five tons of dirt at a time dug out the bed of the waterway, and how landslides—avalanches, containing millions of cubic yards—were coped with, all this will be told. Our editor, Mr. J. Bernard Walker, made a special trip to Panama in order to gather much of the material which will appear in this number. He spent several weeks at the Isthmus, studied every square inch of the ground, spoke with the men who are doing the great work—Col. Goethals, Col. Gorgas, and the rest—and brought with him facts which have not yet found their way into print, and which will first appear in the SCIENTIFIC AMERICAN.

consumed. You find that by making the cost to the consumer bear some relation to the cost of rendering the service, you stimulate the use of current during the day when your plant would ordinarily be loaded but very little, and thus by encouraging the use of current for many hours each day you have put your plant on a self-supporting basis, and have satisfied the consumers by giving them a lower average rate for current because they use it for other than lighting purposes.

You no longer fear that you will be seriously embarrassed by the adoption of high efficiency lamps on the part of your customers; first, because the reduction in units would reduce the number charged at 5 cents, rather than the number charged at 12 cents; and second, because with a well developed heating and cooking load you are not so entirely dependent upon lighting for your revenue. You, therefore, feel in a position to urge your customers to use the high efficiency lamps. You know that they will reduce the customers' bills somewhat, but not enough to cause you to operate at a loss, and on the other hand your customers will greatly appreciate the increased light which these lamps will give at the same time that they reduce the bills. Electric light is thus made cheaper, and is able to compete with gas, not only as far as convenience and safety are concerned, but in cost as well, and the customer finds it possible to use many electrical devices which he would have otherwise found prohibitive from the cost standpoint.

The Heavens in October

(*Concluded from page 2[illegible].*)

obscured the Sun, though other parts of the sky were clear.

The Heavens.

We give again this month a detailed map of a portion of the sky which is now well observable in the evening. The principal configuration shown in it is the great square of Pegasus, near the middle. Apart from this, it is one of the poorer regions of the sky, being remote from the Milky Way, and rather sparsely sown with stars. Among double stars in this region visible in a small telescope we may note Epsilon Pegasi (not far from the western edge of the map, just south of the parallel of 10 degrees declination), which has a companion of the ninth magnitude, more than two minutes of arc away—too wide to be really called a double star, but a pretty object; Mu Cygni (about 20 degrees north of the last) a binary pair, now separated by about 2 seconds, and closing up; and Zeta Aquarii, another fine slow binary pair, separated by 3 seconds, which may be found almost on the celestial equator in 22 hours 22 minutes Right Ascension.

Of the constellations in other parts of the sky, Cetus and the Southern Fish are conspicuous, low in the south; Aquila, Cygnus and Lyra in the west; Ursa Minor and Draco in the north, with Ursa Major on the horizon, Perseus and Auriga in the northeast, and Aries and Taurus in the east, while Gemini and Orion are rising.

The Planets.

Mercury is theoretically a morning star until the 4th, and an evening star afterward; but he is too near the Sun to be observable.

Venus is evening star in Libra and Scorpio, setting about 6:30 P. M. in the middle of the month, and visible in the twilight.

Mars is approaching conjunction with the Sun, and though theoretically an evening star, cannot be observed.

Jupiter is evening star in Ophiuchus, setting about 7:50 P. M. on the 15th.

Saturn is in Taurus, approaching opposition, rises at 7:20 P. M. on the 15th, and is well observable in the latter part of the evening.

Uranus is in Capricornus. He is in quadrature with the Sun on the 2[illegible], crossing the meridian at 6 P. M.

Neptune is in Gemini, and is also in quadrature, on the opposite side of the Sun, on the [illegible].

The Moon is in her last quarter at [illegible]

P. M. on October 3d, new at 7 A. M. on the 10th, in her first quarter at 7 P. M. on the 17th, and full at 8 P. M. on the 25th. She is nearest the Earth on the 7th, and farthest away on the 19th. As she passes round the zodiac, she comes into conjunction with Saturn on the 1st, Neptune on the 4th, Mercury and Mars on the 10th, Venus on the 12th, Jupiter on the 14th, Uranus on the 18th, Saturn again on the 28th, and Neptune on the 31st.

Gale's Comet.

A comet, visible to the naked eye, was discovered by Gale of Sydney, Australia, on the morning of September 9th. On the 17th it was in 14 hours 27 minutes R. A. and 25 degrees 6 minutes south declination, and was moving northeastward at the rate of about 1¾ degrees per day. It is not yet observable in our northern latitude, but will probably be so in a few weeks, though until its orbit is computed no definite predictions can be made.

Princeton University Observatory.

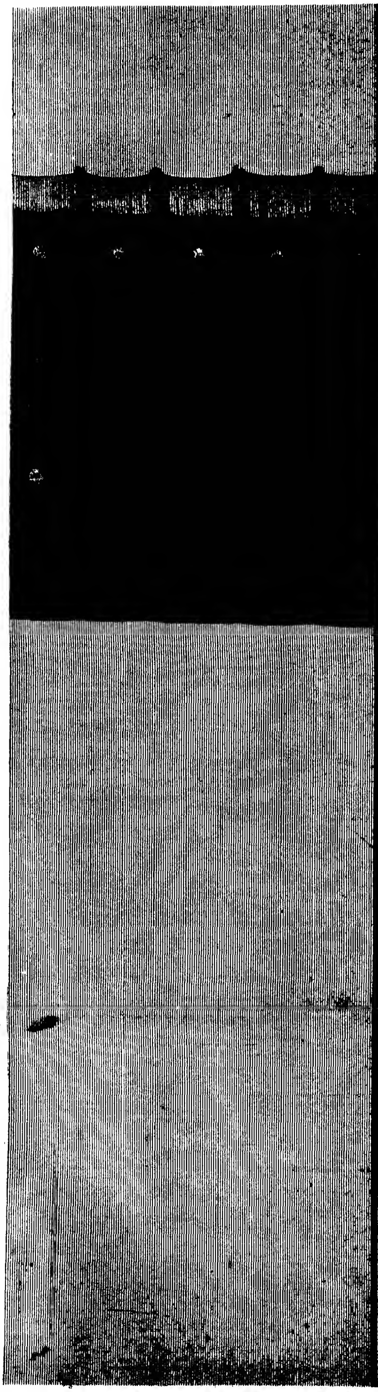
Selling Agent Must Not Imitate His Principal's Goods or Trade-mark

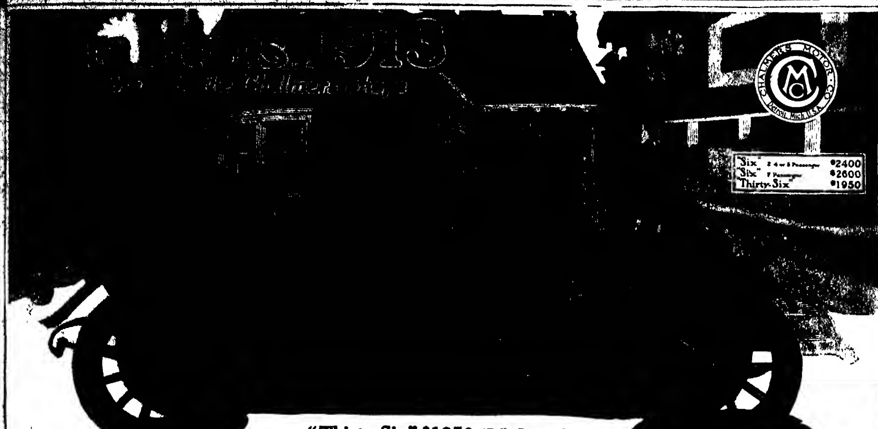
JUDGE MAYER, of the United States District Court for the Southern District of New York, has recently issued an injunction in a suit brought by the Gund Manufacturing Company against the Strauss Manufacturing Company, the Ideal Novelty and Toy Company and George Borgfeldt & Co., restraining the defendants from making or selling merchandise which in appearance simulates the appearance of the merchandise of the Gund Manufacturing Company, or from using in connection with any similar merchandise the trade-mark of the complainant or any simulation thereof, and further from imitating the advertising matter of the complainant. This decision is important to manufacturers and manufacturers' agents, and in brief it is to the effect that one who has as a manufacturer's agent offered for sale and sold the goods of a manufacturer for and on account of the manufacturer, must not after the account is taken from him offer for sale similar goods bearing trademarks like those of the manufacturer or use in connection with such goods advertising matter such as he formerly used in selling such goods.

The facts of the case are these: The Strauss Manufacturing Company was under contract with the Gund Manufacturing Company, to sell a certain toy in the shape of a duck which, when drawn over the ground, opened and closed its bill and gave forth a sound such as "quack-quack." The trade-mark applied to such ducks was "Duckie Doodles," and in presenting them to the trade, certain fancy circulars were used containing catch phrases such as "A Live One," "The Duck That Quacks," and others. After the contract was taken from the Strauss Manufacturing Company, the Gund Manufacturing Company learned that it had made arrangements with the Ideal Novelty and Toy Company to make up some ducks like those of the Gund Manufacturing Company, had applied to such ducks the trade-mark "Duckie Waddles," and had copied the advertising circulars containing the catch phrases above noted and had delivered to George Borgfeldt & Co. a sample of the imitation ducks, which last company was offering them to its customers and soliciting orders.

The Gund Manufacturing Company, through its attorney, Mr. Charles A. Munn, filed a bill of complaint joining all of these parties as defendants, and asking for an injunction, which was granted by Judge Mayer after a full hearing. Judge Mayer remarked at the hearing that the defendants must not make or sell any duck imitating in appearance the duck of the Gund Manufacturing Company.

The decision of Judge Mayer is in all respects in accord with the decisions of the same Court in the automobile lamp and horn cases, and the [illegible] mill case, [illegible]





"Thirty-Six" $1950 *(Fully Equipped)*

FIRST!

Automobile history shows that the Chalmers Motor Company has been *first* in almost every important advance that has resulted to the benefit of the motor car buyer.

This fact means much to you as a purchaser. It is your assurance that we will continue to be *first*. It means that the Chalmers owner always has an advanced car—a car that even in its second or third year is never out of date. It is the strongest sort of reason for yqur confidence in us and in our cars.

Everyone pays tribute to the organization that does a big thing *first*. And public appreciation has kept pace with Chalmers progressiveness.

Here are some facts in automobile history:

The Chalmers Company was the *first* to produce a real automobile at $1500—the Chalmers "30", placed upon the market July 1, 1908.

The Chalmers Company, in bringing out the "Thirty-Six", at $1800, announced July 1, 1911, was the *first* to offer a medium priced car with self-starter, genuine long stroke motor, four-forward speed transmission, Continental demountable rims, and other features previously found only on high priced automobiles, or not found at all on any cars at any price.

The Chalmers engineers were the *first* to turn their attention to the important matters of comfort, beauty, and convenience in cars of medium price. Having built cars which answered every mechanical requirement, they devoted their efforts to refining their cars in these important respects.

Chalmers "Thirty-Six" for 1913 was the *first* medium priced car to combine the following desirable features: Turkish cushions, 11-inch upholstery, nickel trimmings, electric lights, self-starter, new, roomy, flush-sided bodies, long stroke motor, demountable rims.

The Chalmers Company was the *first* to produce a really great 6-cylinder car at a medium price—a truly maximum car embodying not only mechanical excellence, but the utmost in luxury—and still selling at a moderate price—$2400 to $2600.

The Chalmers Company was *first* in its racing record. It won more contests in proportion to the number entered than any other manufacturer—a record not yet equalled.

A Chalmers was the *first* medium priced car to win the Glidden Tour and that when the Glidden Tour was a *real* automobile contest under severest rules. Our "30" won under the same rules as the $4000 and $5000 cars.

The Chalmers Company was one of the first to establish itself on a basis of manufacturing practically all of the vital parts of its cars in its own plant.

Making our own parts is not only more economical for us; it is better for you. The parts-maker is in business to make money. His first idea is quantity production at lowest cost to himself. Our first idea, in making our own parts, is quality. We don't have to think first about cost, for we know at the start that we can save the parts-maker's profit.

The wisdom of our policy of manufacturing our own parts will be more apparent in five years than it is today. Because cars are not bought now merely for one year but for several years' use. *Manufactured* cars last longer, and in addition the manufacturer who makes his own parts can always take better care of his owners.

These are some of the points in which the Chalmers Company has led since it started in the automobile business. You can verify them for yourself.

The biggest reason why the Chalmers Motor Company has been *first* so many times is because we have organized our business properly. We have patiently built up an organization where each department head is the best man that could be found for the job. We have fostered the spirit of co-operation between foremen and workmen and executives. We have encouraged our people to think. For we believe that brain power is more essential than horsepower in running a factory.

And so, because our organization was planned well and because we were willing to accept the suggestions of owners, dealers and our own employees, we were able to establish our leadership in the modern price class in 1908. We have been able to hold it by having a good organization. And we expect to continue because we have the organization, the ability, the capital, the factory and the experience to do it.

To tell you more about Chalmers cars and Chalmers methods, we have prepared an instructive and entertaining book, called "Story of the Chalmers Car." Write for it on the coupon.

And see our cars at the dealer's showrooms. Compare them with other cars. Put them to any comparative test and we believe your first choice will inevitably be a Chalmers.

Send in the coupon today, while you think of it.

Reasons Why 1913 Chalmers Cars Are First in the Estimation of Discriminating Motorists

Two great cars claim your attention as the Chalmers offerings for 1913—the Chalmers "Thirty-Six" (4 cylinders) and the Chalmers "Six" (6 cylinders).

The "Thirty-Six" at $1950, is the new model of the most popular car we ever produced, and is equipped with every convenience and comfort. An all-around car at a medium price.

The "Six" at $2400 to $2600 is a truly maximum car in power, comfort and luxury. And yet, through quantity production and unexcelled Chalmers manufacturing facilities, we are able to offer it at a moderate price.

Note these reasons for the popularity of these two cars.

Comfort—Maximum comfort is to be had in the luxurious Turkish cushions, 11 inch upholstery, long wheel base (130" on the "Six"; 118" on the "Thirty-Six"), improved springs, big wheels and tires

Convenience No other car offers so many conveniences to make driving simple and easy. Such as Chalmers patented self-starter, Gray & Davis electric lights, demountable rims, dash adjustment for carburetor, ideal arrangement of all control apparatus on dash

Beauty Beauty and grace distinguish every line of the new flush-sided metal bodies, the sweeping bell back, the hooded dash. The nickel trimmings, leather lining and sumptuous finish add the finishing touches of perfection

Safety—The most careful attention has been given by Chalmers engineers to the factors of safety wheels, axles, frames, brakes, steering gear. All are of a weight and strength to insure against accident.

Long Stroke Motor—The Chalmers motors are ideal for every requirement mile-a-minute speed, slow running in city traffic, hill-climbing or dogged ploughing through sand or mud.

Four-Forward Speed Transmission—This great improvement first offered by the Chalmers Company in a medium priced car—affords utmost flexibility. You can always select the gear that will carry your car along—through any kind of going—in the fastest time and with the least motor labor.

Rain Vision Windshield—This splendid, substantial windshield is readily adjustable to suit all conditions

Special Silk Mohair Top—No better top is offered on any motor car

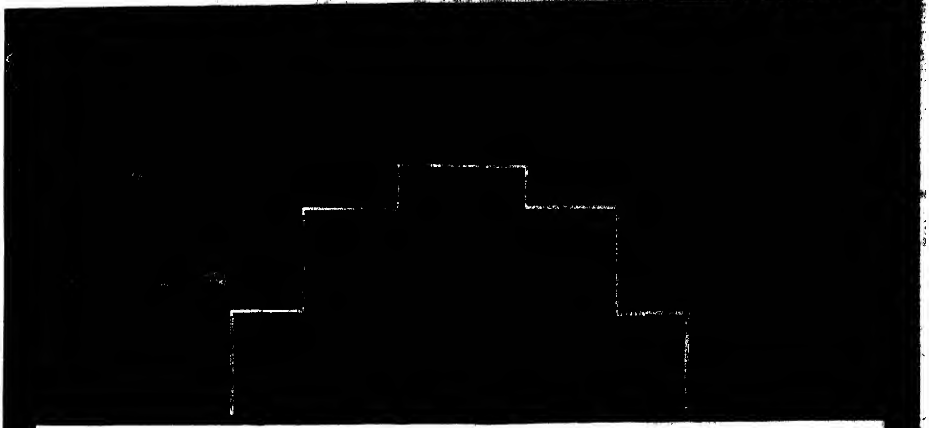
Please send "Story of the Chalmers Car" and 1913 catalog

Name

Address

Sc. Am. Oct. '12

Chalmers Motor Company, Detroit



SIXTY-EIGHTH YEAR

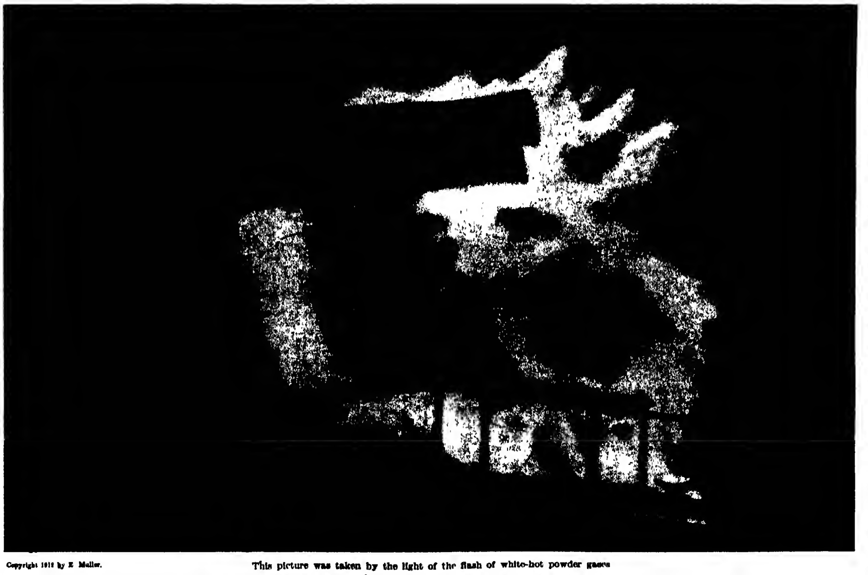
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 15.] NEW YORK, OCTOBER 12, 1912. [PRICE 15 CENTS $3.00 A YEAR

In foreground seaman is wig-wagging result of shots from stern of "Nebraska," which is towing the target 350 yards astern Three of the four shots have passed through target, the fourth, a ricochet, will also strike

Four hits by 12-inch shells fired at 14,000 yards by battleship "Kansas."



This picture was taken by the light of the flash of white-hot powder gases

Night firing. Discharge of a pair of 8-inch rifles on board the flagship "Connecticut."

THE IMPOSING NAVAL REVIEW AT NEW YORK.—[See page 306.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, OCTOBER 12, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions
Mexico, Cuba, and Panama
Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid, ... 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . per year, $3.00
Scientific American Supplement (established 1876) . " 5.00
American Homes and Gardens . . . . " 3.00
The combined subscription rates and rates in foreign countries including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. *If the photographs are sharp, the articles short, and the facts authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Warning Neglected

ONCE more an express train has been thrown from the track at one of those short cross-overs from express to local tracks which are a standing menace to the safety of railroad travel. The accident is the more inexcusable because the New York, New Haven and Hartford Railroad Company, upon whose lines it occurred, was reminded of the danger only last year, when a similar accident occurred to an express train just outside of Bridgeport. The stretch of line on which both accidents occurred has four tracks, the center tracks being generally reserved for express travel and the outer tracks for local trains. When an express train is to make a stop at a station, it has to pass from the inner to the outer track, and this is accomplished by means of a cross-over. Safety of travel demands that these crossovers shall be of such a length that the curvature at the switches shall be "easy," so that if an express train should enter the crossover at high speed, it will not be in danger of derailment. That would be good and safe construction. As a matter of fact, from motives of economy and convenience, these crossovers are made comparatively short, with sharp curvatures at the switches, and a standing order is given that speed shall be reduced to a low limit in making the transfer. If the engineer obeys such orders to slow down, well and good; but it often happens that, either through carelessness or desire to make up time, the cross-overs are taken at a speed too high for safety. This is what occurred last year at Bridgeport and this year at Westport. We pointed out at the time of the Bridgeport disaster that such accidents could be prevented by doubling the length of the crossovers. Had this been done at Westport, the train in all probability would not have been wrecked. This subject is one that may well be commended to the serious attention of the Interstate Commerce Commission.

Honor to Whom Honor is Due

UNDER the title "Eugenics must surely at last be coming to its own," our esteemed contemporary, *American Medicine*, makes some editorial comments which seem to us decidedly unfortunate. The writer opens his remarks with the words: "By the time that an innovation gets real acceptance in England, it must amply justify its existence in other countries." Further we read again: "A final proof of the permeation of eugenic principles, even in slow-moving England, is to be found in the presidential address of the Archbishop of York . . . ."

Are we to infer that the writer is so grossly ignorant as not to know that the whole movement for eugenics *originated* in England, that even the word *eugenics* is the creation of the great Sir Francis Galton, whose death we mourned last year? Is our contemporary unaware of the fact that the world's chief center in this movement is at University College, London, where one of England's foremost scientists, Prof. Karl Pearson, is director of the Eugenics Laboratory founded and endowed by Sir Francis Galton? Or has his patriotism carried away our esteemed contemporary, inspiring those more fervid than judicious remarks? Indeed, is patriotism a proper definition for an emotion which thus clouds a man's judgment? National prejudice seems a more apt term to describe it. Let our patriotism be such as to invite commendation and not condemnation. Let us be fair, and give honor to whom honor is due.

Pulicide

SOME may imagine it to be an easy thing to kill a flea; such delusion will be dispelled by the following statements, which are authoritative, being based on a report on *Flea Destruction* of the United States Public Health and Marine Hospital Service. It should be premised, however, that the investigation noted, though thoroughly scientific, was limited in scope; for only the *Pulex irritans*, the *Hoplopsyllus anomalus* and the *Ceratophyllus acutus*, with two other varieties were examined; and, as every one knows, this is but touching the fringe of the flea question.

Pretty much every insect can be destroyed by corroding it with chemicals, or by suffocating it outright, or by euthenizing it with ether or chloroform or laughing gas. Not so, however, the festive flea, which will survive all these modes of execution combined, with others added. It will survive the agency which kills its "host," such as the rat or the squirrel; and (with its marvelous power of jumping across infinite distances) will find a new boarding place in another hospitable and as yet unvivified pelt. Besides, when can one say that pulicide is a deed accomplished? A flea that has not moved for half an hour has been pronounced dead; yet the abandoned creature has afterward sprung up as ready as ever for the part allotted it in the cosmic scheme by a hopelessly inscrutable Providence. Again, what were the conditions of the flea before the attempted vivisection? Was it moribund, or was it physically up to par? It has been calculated that, size for size and weight for weight, if a man's jump had as much power behind it as a healthy, robust flea's, he (the man) could easily, from the street, clear the golden ball topping the flagstaff of the Singer building. So, for the conditions of the experiment, it should be known beforehand if the creature has its jump in normal working order. Again, climatic conditions must be considered; the flea will hop and bite with energy in dry, crisp weather; on a soggy day he may not care to do these things, and so may only seem to be dead.

It is almost impossible to drown fleas by dropping them into water; but soap and water will do for any flea. Thus is the flea the hobo among insects; for dipped in tincture of green soap he is dead beyond peradventure in two minutes, and no flea of the five kinds indicated could live after being soaped. Another evidence (among so many) of the disreputable character of the flea is that when soaked in absolute alcohol, he may become paralyzed; but he will certainly recover, and (as in the old song) when one puts his finger on him, behold he is not there. The strongest whiskies are only fifty per cent alcohol, and there is surely no record of any human survivor who has been submerged in whisky; yet fleas come out seemingly all the better for it, after being soaked in absolute alcohol (98 per cent). Again, a flea left to swim in formalin (a very powerful insecticide) was "apparently dead in twelve hours," but "revived." It took 100 per cent phenol more than one minute to kill a flea, etc. The conclusion is that water is of little value in flea destruction; glycerine is practically inert; alcohol is practically inefficient; kerosene and miscible oil are efficient; formalin, phenol, mercuric chloride and trekesol in the strength used as disinfectants are of little value, and powdered sulphur of none; the fumigants, bisulphide of carbon, hydrocyanic acid gas, and sulphur dioxide are "highly efficient in the strength employed for flea destruction."

It would seem, on the whole that the surest way to kill a flea (and be able to testify under oath that he is really defunct) would be to place him on one of those impenetrable plates used in naval warfare, and confine him thereon by means of cables fastened securely to each of his several legs; then to train upon him (from as near a distance as would be feasible) an irresistible projectile from one of those twelve-inch guns. If the flea should not (by reason of the phenomenal spring mentioned) break away and get out of range, it might fairly be assumed that its destruction beyond resurrection had been consummated; that is, considering the unerring aim for which the American navy is so justly famous; if the experiment were tried in the Cuban or the Patagonian navy, one would be rash to guarantee the result.

The Farmer and the Beef Famine

NO other one thing contributes more to the success of the Americans in mechanical endeavor than beef—good red-blood-making material.

Nobody knows better that there is a beef famine than the mechanic. Nobody will appreciate more readily why there is one than he when he is informed that the number of beef cattle on the farms of the United States have declined from *fifty-one and a half millions* in the year 1907 to *thirty-seven and a quarter millions* in 1912 (Year Book of the U. S. Dept. of Agriculture, 1912, page 629), and that the decline still continues at the rate of about *two and a half millions* a year. No structure of any kind, whether intended for human habitation or human food, could stand such a loss as this on its underpinning without damage and loss of the most serious kind.

To a mind trained in mechanics or physics it is clear that the trouble is lack of trusses instead of presence of trusts.

OUR BEEF STRUCTURE NEEDS ADDITIONAL SUPPORT.—Where are we to look for it? In spite of the high prices of cattle and the good prospect of profit, out of all the States in the Union only one, Florida, a cotton-growing State, increased its cattle; namely, from 736,000 in 1911 to 756,000 in 1912—not much, but enough to give a very valuable suggestion, as will be seen. The States in which there was no decline are as follows: Vermont, Massachusetts, Rhode Island, three comparatively small New England States. Then Delaware, Wisconsin, Utah, and Nevada. Next more cotton-growing States, Georgia, South Carolina, Alabama and Mississippi. All the big ranching States from Montana to California, including Texas, and excepting only Utah and Nevada, showed heavy declines. The logic of this is clear: We must look in the future to the farms and not to the ranches for our beef.

If we look carefully for that portion of the country in which we can hope most quickly to increase our beef supply, we will find it without the least doubt in the cotton-growing States. There is now grown and going to waste in these States enough grass to raise and fatten enough more cattle of the right sort under favorable conditions to reduce the price of dressed beef five cents a pound to the consumer, and still leave a handsome margin of profit to the cattle grower. Those by-products of the cotton plant itself, cottonseed meal and hulls, are extraordinarily abundant and cheap, hulls at less than half the price of hay, and meal at less than half the price of corn. Over one thousand mills are making this feed and are scattered from one end of the cotton-growing territory to the other. Enough more grass is ploughed under in the clean cultivation which cotton requires, to quadruple the number of cattle now in the South. If the other cotton States will follow the example of South Carolina of intensive cotton cultivation and the liberal use of commercial fertilizers, they will be able to raise as much cotton as they are doing now, with less cost per pound, and can use with advantage 25 per cent of their present cotton acreage for pasture. (South Carolina gets 280 pounds lint cotton per acre to Mississippi's 170 pounds per acre.)

There are plenty of native cattle already in the South to make a start with, though most unevenly distributed and varying greatly in quality and size, as shown by their number in proportion to population and value at the farm. For instance, North Carolina has about one head to six of population—value $12.60; Georgia, about one head to four of population—value, $11; Mississippi, about one head to three of population—value, $10; Oklahoma, about one head to one and one third of population—value, $21.50; and Texas, about one and one third head to one of population—value, $17.

If the older cotton States had as many cattle in proportion to population as Oklahoma and Texas (and the same sort of cattle) as they might have by natural increase with pure blood beef sires in ten years without importation, the beef problem would be solved.

It is not cotton mania that has prevented an abundance of good cattle in the old cotton States, but partly the presence, partly the injury wrought by the cattle tick, but chiefly ignorance and indifference. Intensive cattle raising, with the minimum of pasturage and the maximum of feed raised and carried to the cattle, coupled with intensive cotton production with commercial fertilizer, is the greatest aid we have to cotton growing, and it will be along this line that the old cotton States will be induced to grow cattle. The Government is already pecking at the cattle tick by counties with mild aid from county and State. A vigorous campaign by National and State governments with men and money behind it could eradicate the cattle tick completely and forever from the United States in one year. A campaign of education equally able and vigorous for the same length of time would convert the South to cattle raising of the right sort, not in place of, but in aid of cotton growing.

There is not a consumer of beef in the United States, nor a packing house in the country, a cotton mill, oil mill, fertilizer factory, merchant, planter or banker in the South that would not be greatly benefited by two such joint movements.

Engineering

Reduction of Railroad Speed.—The Pennsylvania Railroad Company has issued orders restricting the maximum speed of all passenger trains on the system east and west of Pittsburgh to seventy miles per hour. Careful consideration has also been given to the existing speed restrictions on curves.

Speed of the "Princess Royal."—It has been unofficially announced that at the recent test of the new British battleship cruiser "Princess Royal," which is a sister vessel to the "Lion," the new vessel exceeded the record of 31.7 knots made by the latter battleship cruiser. The "Princess Royal" is driven by turbine engines of from 70,000 to 75,000 horse-power. Her displacement is 26,350 tons and she carries eight 13.5-inch guns in four turrets, so disposed that they can all be discharged either ahead or astern or on either broadside.

New Depth Record for a Submarine.—The new submarine boat "F-1" established a world's record for depth during a six-hour submerged cruise in San Francisco Bay on September 5th. The boat went down to a depth of 283 feet. The vessel maintained this depth for ten minutes while traveling at a speed of six knots, then rising to a depth of 19 feet, it proceeded at a speed of eight knots. The previous record for depth was held by the "Seal," a Lake type submarine, officially designated "G-1," which went down to a depth of 256 feet.

The New Transatlantic Liner "Britannic."—The White Star Company has made the official announcement that the new 50,000-ton liner now under construction will be christened the "Britannic." This vessel, which is similar to the "Olympic," will be the largest British-built ship in the world. It will contain a number of changes in design so as to protect it from a disaster like that which befell the "Titanic." It will be provided with a complete inner skin extending well above the load line, throughout the vulnerable parts of the vessel. The bulkheads will also be higher, and the vessel will be able to float with six compartments flooded.

Largest Freighter in the World.—The largest vessels in the world designed for carrying freight exclusively are the "Col. James M. Schoonmaker" and the "William T. Snyder, Jr.," built for operation on the Great Lakes. They measure over all 617 feet, molded beam 64 feet, molded depth 33 feet, with a deadweight carrying capacity at 20-foot draught of 13,200 tons. The vessels carry water ballast in side tanks and in a double bottom which is 6 feet deep. The total water ballast capacity is 9,440 tons. Each vessel is equipped with a quadruple expansion engine of vertical inverted type with an estimated horse-power at ninety revolutions per minute of 2,600.

Terminals for the Barge Canal.—In order to take care of the traffic on the New York State barge canal, which will be completed in 1915, an expenditure of $18,800,000 has been authorized for canal terminals in New York city and other cities along the canal. In New York city there will be fourteen canal terminals, costing altogether $9,740,000. The balance of the money will be spent in building terminals at twenty-one different cities and towns. Warehouses, sheds, cranes, derricks, etc., will not be built at the terminals until after the canal has been completed and the character and quantity of the freight to be handled has been determined.

Capacity of the Gatun Lake.—During the week from September 2nd to September 9th, 5.74 million cubic feet of water poured into the Gatun Lake, raising its surface from 39.06 feet above sea level to 42 feet above sea level. The total quantity of water reached 40.03 million cubic feet which is equivalent to 299,424,400,000 gallons. For purposes of comparison we may consider the Rio Grande reservoir, which when filled has a capacity of sixty-five and a half million cubic feet, or less than one seventh of the average daily flow into the Gatun Lake. When the surface of the lake reaches a level of fifty feet above the sea it will contain 58.65 million cubic feet of water, and when it reaches eighty-seven feet, or the proposed maximum level, the lake will contain 192.27 million cubic feet.

"Selandia's" Consumption of Oil.—Some interesting statistics on the oil consumption of the Diesel engine-driven "Selandia" are given in *Engineering* (London). On the outward maiden voyage the weather was fair after the first two or three days. On March 11th, the first day out, the oil consumption was 9.8 tons, and a speed of 9.2 knots was maintained. The highest speed was 12.7 knots, which called for a fuel consumption per day of 10.1 tons. The most efficient day's run required the use of 9.6 tons of oil, with which a speed of 12.4 knots was developed. On the homeward voyage the weather was decidedly unfavorable, and yet the daily consumption of oil did not exceed 8.8 tons. The best day's run was made on 8 tons of oil, with which a speed of 8.3 knots was maintained. Had the steamer used coal in place of oil, it would have required three or four times as many tons of fuel.

Electricity

Wireless Iconography.—We learn from *La Revue* that a young Italian experimenter, Francesco de Bernocchi, the son of a Turin merchant, has been successful in his attempts to send pictures by the Marconi process. Though only 25 years of age he has been interested in the subject, it is stated, since 1897, having been inspired by Prof. Rhigi's investigations of the Hertzian waves. He has now succeeded in transmitting images, drawings and autographs which retain the precise features of the original with great fidelity.

Electric Signs in Uruguay.—According to the report of United States Consul, F. W. Goding at Montevideo, Uruguay, American electric signs are being introduced into that country and are becoming very popular. Recently an electric display sign with a capacity for forty advertisements was installed in Montevideo. Each advertisement is displayed for seven minutes. The young Uruguayan who installed the sign has found it so successful that he is planning to install a number of others of greater capacity in other cities of South America.

Wireless Telegraphy Spark Gaps in Running Liquids.—In wireless telegraphy the spark in the electrically oscillating circuit is liable to degenerate into an arc where large amounts of energy are used. Recent experiments to determine the effect of interposing a running liquid in the spark gap have shown that the voltage required is lower than in air and that the efficiency depends on the rate of flow of the liquid and upon the voltage applied, and not greatly upon the length of the gap. Water may be used, but oil gives better quenching and eliminates the deafening noises of the air spark.

Effect of Carbon on the Conductivity of Steel.—According to statistics published in *Comptes Rendus*, the resistance of carbon steel increases with the per cent of carbon. The resistance of nickel steel also increases with the addition of carbon and also with the increase in percentage of nickel up to 35 per cent. In manganese steel the percentage of carbon does not seem to affect the resistance to any great extent. The greatest resistance is found when 12 to 13 per cent of manganese is used. Chromium steel, too, seems to be unaffected by the carbon content, but the resistance is increased and reduced periodically with the increase in percentage of chromium. Tungsten steel also shows a variation that is quite irregular.

A Large Protective Reactance.—An effective way of automatically protecting large dynamo-electric machines from momentary short circuits is to include a "reactance coil" in the outgoing circuit of the machines, the electromagnetic inertia of this coil serving to check the abnormal rush of current. The 5,000-kilowatt turbine-generators installed in a London electricity supply station are now adequately protected from the severe strain of the momentary "shorts" which are common to electric railway service by a large oil-immersed water-cooled reactance coil designed to reduce the short-circuit current to somewhat less than one half the value it would otherwise attain, namely, 10,000 amperes. The coil reduces the power factor less than 3 per cent.

Why do Electric Waves Follow the Earth's Curvature?—An interesting hypothesis has recently been suggested by an English physicist to explain how it is that electro-magnetic waves emitted at a wireless telegraph station in Cornwall can be received at a station on the coast of America. If we compare such a sending station (as far as wave-length is concerned) to a source of light on the surface of a sphere about ¼ inch in diameter, obviously no light from the source could reach even one quarter of the way around the sphere; but if the sphere is surrounded by thin envelopes of media whose refractive indices decrease from the inner to the outermost, light will be transmitted all around the sphere by successive refractions and reflections. According to the new hypothesis the electric waves are transmitted in an analogous way, viz., by the variation in ionization of the earth's atmosphere.

The Telephone for Detecting Faults in an Alternating Current Supply.—A telephone device called the phasophone, for determining faults in alternating current cables at their inception, thereby preventing loss and delay by serious short circuits, is described in a German magazine. The instrument, which consists of a mica condenser, a telephone receiver, a spark gap, a non-induction resistance of about one megohm, is employed by connecting it to the particular cable which it is desired to test and listening for five or ten minutes at a stated time each day to the musical note given by the telephone receiver. The alternating current generated by the supply station normally gives a pure tone in the receiver, but if there is a leak of varying resistance, caused for example by a "swing" on the line, the tone is interrupted; and characteristic interruptions of the tone are caused by bad contacts, faulty operation of generators, etc. Once the existence of a fault on a particular cable is detected by this means, the location of the fault can readily be found.

Science

An Interesting Etruscan Sarcophagus.—An interesting Etruscan sarcophagus adorned with bas reliefs representing episodes of the siege of Troy and bearing traces of their original coloring has been found in a tomb.

Hydrogenated Oil and Milk Butter Substitute.—Carleton Ellis of Montclair, N. J., has secured a patent for a butter substitute or butter-like composition in which edible hydrogenated oil is incorporated with milk material by emulsification.

Discovery of a Relic of André.—A telegram from Tromso received at Christiania on September 13th states that the Norwegian steamer "Beta" discovered on September 1st, to the south of Foreland, a buoy marked "Andre's North Pole Expedition, 1896, No. 10." The buoy was made of cork and covered with copper.

Making Holes in Rubber Corks.—In making holes in rubber corks much annoyance is caused by the punch making "tapering" holes and "running to the side" A little ammonia water poured on the rubber and the boring instrument causes the hole to become of uniform size at every point and the operation is accomplished with much more ease.

How to Clean Gas Mantles or Gas Burners.—A good way to clean gas mantles or gas burners that are blackened by carbon deposits is to sprinkle sodium chloride or "salt" upon them while burning This causes the carbon to burn away and prolong the life of the mantle and increase the efficiency of the light or burner. In laboratory combustion furnaces deposits of carbon can thus be removed.

Honors for an X-ray Victim.—Mlle Weidemann, said to be the first victim of duty to the cause of the X-ray, has been decorated with a medal by the Minister of the Interior of France. Mlle. Weidemann was employed in 1898 in the radiographic laboratory of a hospital. Hardening of the skin had set in. Last year she had to have both hands amputated. Ultimately she must die; for the amputation of her hands has not stopped the ravages of the disease

Railroad Dust as a Germ Carrier.—The interest taken of late in the subject of dust, especially along common carriers, is such as to attract attention in all quarters. Recently the Hon. Judson C. Clements of the United States Interstate Commerce Commission has expressed his opinion as to the dust discharged along railroads and similar public highways. It transmits disease germs of a contagious character, he stated, and announced his advocacy of a general law for the regulation of the matter in the interest of the public health Such a law would doubtless bring forth improvements in the means for controlling the discharged dust and should be of interest to inventors skilled in the subject.

The Twelve Biggest Brains in the World.—In point of brain weight, the following in the order named are the twelve leading names, the weights being indicated in grammes: Ivan Tourgenief, Russian novelist, 2,102; Joseph Bouny, French jurist, 1,935; George Cuvier, Franco-German naturalist, 1,830; E. H Knight, American mechanician, 1,814; Franz X. Kraus, German theologian, 1,800, John Abercrombie, Scottish physician, 1,786; Benjamin F Butler, American statesman, 1,758; Edward Olney, American mathematician, 1,701; Herman Levi, German composer, 1,690, A Winchell, American geologist, 1,666; William M Thackeray, English novelist, 1,658; Rudolf Lenz, German composer, 1,636.

The University of Frankfort.—Measures are being taken to organize a new university at Frankfort, and recently the Prussian government authorized this measure, provided the municipality would engage to supply the necessary funds for constructing the university buildings and keeping them up. Burgomeister Adickes now states that the needed amount of capital amounting to $1,800,000 has been entirely subscribed, so that the founding of the new university is an established fact. We may also note that E. Solvay, desiring to contribute to the work undertaken by Prof. Nernst, who is director of the Physical Chemistry Institute of the Berlin University, has offered the sum of $2,000 which will be renewed every three years.

Eighteen Thousand Dollars for the Jardin des Plantes.—An anonymous donor has lately made a legacy of $18,000 to the Natural History Museum of Paris (Jardin des Plantes), and this sum will be devoted partly to making improvements in the laboratories of zoology and anthropology and in part to the maritime laboratory at Tatihou on the Channel coast. On the other hand it is announced that the extensive collections of fossils from the Paris region, Albania, Australia and Tasmania, belonging to the eminent paleontologist Bonnet, recently deceased, have been left by him to the museum. He bequeathed his entire fortune to the Academy of Sciences. M. Osmond, the well-known metallurgist, left the sum of $20,000 to the Science Mutual Aid Society, $20,000 to the Encouragement Society and $60,000 to different philanthropic institutions.

While the cost of grading is heavy, stone for the foundation and other work costs practically nothing.

How One County Built a Good Road

The Story of a Brick Pavement in West Virginia Hills

By J. M. Miller

The road follows the bed of a small creek for a short distance in a narrow valley. It was necessary to cut an entirely new road.

THE precipitous hills overlooking the Ohio River, in Grant district, Hancock County, West Virginia, and about forty miles from Pittsburgh, will soon be traversed by fine brick-paved driveways suitable for the speediest automobiles and surpassed by few boulevards in Pittsburgh. The farmers of the district, some of them living in one-story cottages and keeping their horses and cattle in log stables built one hundred years ago, have authorized the expenditure of $125,000 for the construction of paved highways, and the laying of bricks has already been commenced. Ten miles of roadway nine feet wide is to be paved with brick.

Most of this road winds up and down hills almost as precipitous as mountains. In some places the roadway climbs the hill at an angle of almost forty-five degrees with a sheer drop on one side of hundreds of feet, while on the other there is a high cliff. Many of the hills traversed by these roads are densely wooded and in some places the roadway before paving, appeared to be little more than a mountain trail. The paved road will be paralleled by a dirt driveway of the same width as the pavement wherever the lay of the ground will permit it.

It was only by clever political strategy, such as would have done credit to the boss of a downtown ward in a large city that the persons interested in the improvement were able to get even a small bond issue to provide funds for the work. A special election to determine whether Grant district should issue road improvement bonds to the amount of $125,000 was requested by petition for October, 1911. In October the roads in Hancock County are nearly always muddy, and in 1911 the indications were that they would be worse even than usual. In this the promoters of good roads were not disappointed. Buggy wheels sank deep into the soft elastic clay and horses could barely struggle through the mud. The result was that farmers who had previously opposed the issue of bonds to pay for better roads, voted in favor of the project after they had struggled through the mud to the polls. Moreover, it being a special election to decide upon road bonds only, many voters not particularly interested in the measure stayed at home. Most of these men would have voted conservatively against any increased expenditure of public money on general principles, had they been drawn to the polls by the varied interests of a general election. As it was they were not quite energetic enough to venture out over the muddy roads to oppose an effort to secure better ones. The clever planning of the good roads advocates was rewarded for the vote showed that forty-seven in excess of the required sixty per cent of all votes cast were secured in favor of the bond issue.

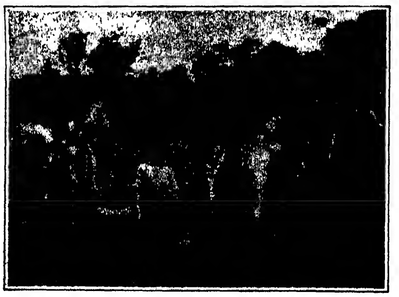
Prior to the vote on the bond issue in Grant district two efforts had been made to secure the peoples' approval at the Hancock County polls for a large bond issue to be expended for the improvement of the principal roads of the entire county. Each time the total vote of the four districts in the county was against the improvement. In Grant district only, where the farms are roughest and stoniest, and where the farmers are poorest, was the vote favorable to the bond issue. In order to take advantage of the favorable local sentiment the promoters of good roads arranged with the Hancock County court to give Grant district an opportunity to vote separately on a smaller bond issue for the improvement of its own roads. Clever management of the campaign and a wet election day did the rest.

Following the election the county court appointed a commission to prepare and market the bonds. When this work had been done, in order to remove any suspicion of collusion and graft, a second commission composed of different men from the first, was appointed to determine what roads were to be improved, to select the materials, and to have charge of the actual work.

The first and perhaps the most difficult task was to determine what roads should be improved, for prior to the election the farmers along every byroad in the district had been encouraged to believe that the highway leading through his farm stood just as good a chance of being improved as any other. Where a farm was very remote the owner's support for the bond issue was sought by a

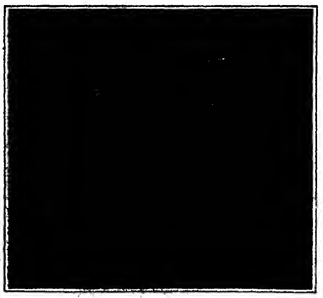
(Concluded on page 311.)

It was decided to pave the road with brick as far as the Pennsylvania State line, a distance of three and one half miles.



The contract for grading, paving and curbing was let by competitive bidding after the specifications had been well advertised. Local farmers, however, did much of the grading.

Graded and ready for paving. The paved road will be paralleled by a dirt driveway of the same width as the pavement wherever the lay of the ground will permit it.



In some places the roadway, before paving, appeared to be little more than a mountain trail with deep hollows in which water had collected.

With minimum of friction and slow speed of chain travel, very little power is required to keep the ice moving and to elevate it at the bridge.

A 2½ horse-power motor, connected by 200 feet of flexible cable with the electrical supply of the nearest building, drives the ice harvester.

Harvesting Ice by Electric Power

A Home-made Ice-carrying Machine

By Putnam A. Bates, E.E.

FOR several years I have struggled through the winter season with the feeling that another year I would find a better plan for filling my ice house than that which is customary in our section of New Jersey.

The standard method with us has been to engage several teams early in the winter season and to give the instructions that at the first "spell" of ice weather those teams were to haul, until the two-hundred tons had been safely put away. To the average person this might seem sufficient to get the job done, but, to one accustomed to rural conditions such an understanding has nothing definite about it. For example, my instructions were just the same as those from eight or ten other farmers in the same locality, and the teams referred to are continually working around here, there and everywhere. They work when it is clear, but not when it storms, the result being that probably three times as much work is engaged for as would be possible to carry out.

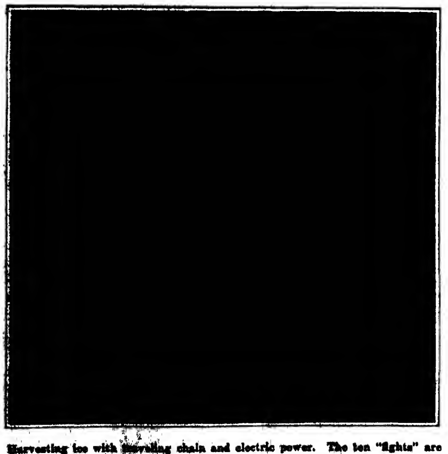
On this basis it is plain to see that some one must be disappointed, and it may or may not be my turn, depending upon how the problem works itself out. And again the lake we all cut from is some five miles away, over hill and dale, so that one load a day per team is apt to be the maximum rate of transportation.

What a pleasant surprise, therefore, it was when one day this spring, just after I had settled up with my teamsters for the usual winter ordeal, on a basis that made the cost of a ton of ice on a par with a ton of coal, to receive from a friend in a neighboring county a letter telling how he had designed a mechanism operated by electricity that would harvest all the ice you could possibly need, right from a little pond near at hand and without the services of a single wagon, sled or team.

The accompanying illustrations show pretty clearly the general scheme. The inventor of this ingenious labor-saving method is Schuyler S. Wheeler, who farms on a somewhat larger scale than I do, just over the Bernardsville Mountain in the county of Somerset.

Mr. Wheeler calls this mechanism an "ice-carrying machine," and, in fact, that is just what it is, for the blocks of ice when once on the runway are drawn along by an endless chain which in turn is driven by an electric motor supplied with current from a small generating plant which was installed for the purpose of lighting the house and outbuildings.

Present method of cutting ice. Hand sawing is slow work. An electrical motor could be mounted on the carriage of a circular saw; the mechanism being drawn over the ice as with a horse-saw.



Harvesting ice with traveling chain and electric power. The ten "flights" are 33 feet apart on the chain, five on the "going side" of 165 feet. The return trough for the chain is fastened up tight against the slide on its underside.

The complete harvesting outfit is shown in the illustration. Under its initial test it proved eminently practical and satisfactory in every way, and made it possible to harvest about two hundred tons of ice, using five men and no teams, in four days. Previously it had been the custom to employ four to six teams, four or five days, in addition to these men. While the outfit was constructed only with a view to meeting the needs of a small private plant, there is no reason why the construction should not be made heavier and the same idea applied to commercial undertakings of like character. In the instance cited, however, the "rig" was made light enough and simple enough to be warranted in a private place.

The "flights" are 33 feet apart on the chain, and there are ten of them in 330 feet of chain, or five on the going side, covering a distance of 165 feet. The slide was made in 12 or 14-foot sections, each one having at one end only a cross batten or supporting foot, the other end resting on the battened end of the next section. The return trough for the chain is fastened up tight against the slide on its underside and the whole rested directly on the ground. Immediately after harvesting, the chain was taken off and the sections lifted and nested on top of one another in a little covered shed or shelter alongside of the ice house.

The working head is supported on a rectangular wooden frame, which rests and locks on four short posts set permanently in the ground. The power was brought from the nearest building having electric light, by 200 feet of flexible cable. The 18-inch diameter sprocket wheels made 28 revolutions per minute, and at this speed the chain picked up a cake of ice four times in fifty seconds. The elevating bridge was hinged at a point alongside the main shaft and not upon it, to relieve it of friction, and this and the slow speed of the chain and one or two other power-saving features, resulted in the operating of the whole with 2¼ horse-power of electricity when the bridge was half elevated, as shown in one of the engravings. When fully elevated about 2½ horse-power was drawn. Nearly all the power was required for moving the chain, etc., the actual power required for moving and elevating the ice being only about a quarter horse-power. This brought the power requirements easily within the capacity of the isolated electric plant that was installed only for lighting purposes.

In fact, one day when the gasoline engine did not work well, the ice plant was operated by the house lighting storage battery.

At the water end of this ice slide is hinged an apron that may be lifted out of the water for re-adjustment. It may be lifted by hand and no tackle or overhead rigging is needed. It is simply provided with a foot at the outboard end for resting on the bottom of the pond, which in this instance is rather shallow, being a surface ice pond—advantage having been taken of a natural depression in the ground at a very favorable location for the ice making.

The sections of the runway are numbered consecutively except those in the middle part of the run that are interchangeable with one another; these are all given the same number.

One of the illustrations shows the method of cutting. This small carrier at the low speed at which it runs, was able to handle as much ice as four men could cut. In fact as the carrier was so easily stopped and started it quickly became the practice to run it for a short time only when needed.

When a motor driven ice saw has been devised, which will be constructed on the plan of the electric floor surfacing machine and may be drawn or pushed about over the ice, this method of harvesting will be quite simplified and doubtless would require only two men to handle, say, one hundred to three hundred tons as might be required on any fair sized farm not equipped with an artificial refrigeration plant.

A peculiar coincidence of this interesting installation is that the relative location of the ice house, the nearness of a suitable depression for the pond, and the need for a new method at my own farm are so markedly like the conditions obtaining here that I believe the outfit would be equally serviceable if moved from one place to the other, so simple and useful is the whole scheme.

Labor-saving Devices for the Home

By Hayner H. Gordon, Ph.D., of the U. S. Patent Office

STUDY all the hunting and fighting implements from the stone age to the present time, and you will find that each instrument of death was adopted in turn because of its labor saving character. The same holds good in all arts. It appears in the art of illumination evolved from the pine torch. Man found that with its light he could accomplish tasks at night which formerly he could do only during daylight. He thus became more efficient, and the pine torch, therefore, became a labor-saving device. And the electric light of to-day is after all a labor-saving device just as the pine torch of olden time.

The purpose of this article is to treat of a few labor-saving devices for the home. It would, of course, be impossible in any one article or a series of articles, even to touch on the great multitude of devices of this character. In connection with the home as with the world in general it should be stated that electricity is perhaps the greatest servant of all. We only have to stop and think what life would be to-day without the telephone or telegraph or the electric light. The science of electricity has had more to do in reaching the present state of civilization than all the other sciences put together.

The Electric Fireless Cooker.

The modern electric cooker or stove with its time and temperature control, apparently leaves nothing more to be done in the culinary line, unless perhaps, some horticulturist invents self-cooking vegetables. The fireless cooker, which has come into use during the last six years, is a wonderful labor-saving device for the housewife, but all the fireless cooker did was simply to utilize the heat units to the fullest extent, given to the food before being placed therein. The electric stove or cooker goes one step farther and gives the necessary heat units for cooking to the food while placed in the cooker. In brief, the electric stove consists of two heating chambers built as a unit upon the heat insulation principle. Built into the door of each chamber, is a thermometer controlling an adjustable electric switch which may be set to open at any desired temperature. This switch controls the current supply to the heating element of that chamber. In series with the chamber-controlling switches, is a master switch under control of an alarm clock, which may be set to close the switches at any desired time. With this stove the preparation of a full dinner becomes a simple matter. The prepared vegetables are placed in one compartment, the thermometer being set to boiling temperature; the meat is placed in the other compartment, that temperature being set to roasting temperature. The housewife then sets the clock to turn on the current at the proper time, and goes off to the matinee or spends the afternoon shopping with some friend. At the proper time the clock switches on the current, and the respective thermometers regulate the current, so as to supply just exactly the proper amount of heat to each compartment. Ten minutes before dinner time the compartments are opened and the food, which contains all the natural juices unaltered by gas or products of combustion, is placed upon the table. It is said that the compartments in a stove of this type are so well insulated that no more heat is radiated from them than from a sixteen candle-power electric lamp; and with gas at a dollar per thousand cubic feet and electricity at ten cents per kilowatt hour, that the electric stove costs far less to run than the gas stove. There are a series of connecting sockets upon the top of the stove in which electric broilers and coffee percolators may be attached.

The Improved Vacuum Cleaner.

Perhaps no other device has come into such common use in the household recently, as the vacuum cleaner. The cleaners are made in two general types for the household, the first of these being the stationary type, which is generally installed in the basement of the house, and a suitable pipe line run to each floor or room where an outlet is placed. The vacuum cleaner consists of three principal parts: the dust tank, the pump, and the driving motor. In the type just mentioned, the dust tank consists of a steel tank about three feet high and a foot and one half in diameter. The air enters the top of the tank from the pipe line and passes down through a conical cheese cloth funnel to the bottom of the tank, from which it is drawn by a rotary suction pump driven by a ½ or ¼ horse-power motor. The dust removed by the cleaner is caught in the cheese cloth funnel and emptied out from time to time. The other type of cleaner is the portable type. This consists of much the same arrangement on a smaller scale and placed upon casters, the electric driving motor being connected by means of a flexible cord with any lamp-socket. The vacuum pumps used are of the bellows type, and consist of two boards hinged together at one end and fastened together at the edges by a leather strip, in a manner similar to the old blacksmith's bellows. One board is stationary and the other is swung back and forth by a crank driven by the motor. This type of pump is not used so much at present; more or less trouble was caused by the wearing out and cracking of the leather.

The latest type of pump consists of an impeller wheel or fan placed in a close fitting cylindrical casing and driven at high speed by the motor; the air is drawn in at the center and thrown out at the periphery. This type of pump has no wearing parts except the bearings, which are generally provided with some automatic oiling device. The vacuum cleaners are equipped with a suction hose and a variety of nozzles for different types of cleaning. The motor used in connection with the portable type of cleaners uses only a few cents worth of electricity per hour so that the cost of cleaning is low.

Hot-water Heaters.

A hot-water heater at first sight may not appear to be distinctly a labor-saving device. But when we stop to think of the days of our grandfathers when the bath tub was a luxury and all the hot water for the bath or the laundry had to be heated by means of a coal or wood fire, we can see how the time-saving, and, therefore, labor-saving idea enters into connection with the modern hot-water heating system. The newest type of hot-water heater in practical use is of the automatic type, giving unlimited hot water at any time of day or night upon the turn of the faucet. This heater consists of a long copper heating coil through which the water passes on its way to the hot-water faucet; underneath the coils is a series of gas burners operating upon the Bunsen or blue flame principle. The gas pressure is regulated by a double form of control; the pressure valve regulating the supply of gas to the burner by means of the flow of the water, and a thermostat control regulating the gas by the temperature of the water. When a hot-water faucet connected with the system is opened, the pressure upon a diaphragm is reduced and the gas is turned on; the main burner being lighted from a small pilot flame which is kept burning. The water is heated, as it runs through the coils, to a temperature corresponding to that at which the thermostat is set. It is stated that the efficiency of a heater of this type is over eighty per cent, that is to say, over eighty per cent of the total heat value in the gas is directly given to the water to raise its temperature. The ordinary tank system in which water is heated by the ordinary type of gas heater and then accumulated in the tank, with constant radiation taking place, has only thirty-five per cent efficiency. A heater of this type uses about four cubic feet of gas per minute when delivering four cubic feet per minute of hot water at a temperature of 140 deg. Fahr. This type of heater works very well in conjunction with a hot-water tank connected to a hot-water coil in the firebox of the househeating plant. The instantaneous heater is connected in the hot-water line between the tank and the house service. In cold weather, when the furnace is being used, there will be a supply of hot water in the tank. As long as this water is over 140 deg. Fahr., the thermostat control [illegible]

[illegible] ing 100 pounds, [illegible] from a liquid to a gas [illegible]. The mode of operation is as follows: [illegible] drical tank at the [illegible] tion of aqua ammonia, this tank is heated by either gas or electricity. Ammonia gas being driven off by the heat passes through a series of cooling coils and being cooled, liquifies in a small cylindrical chamber inside the refrigerator surrounded by brine solution. When all the gas has been driven off from the outside chamber, the source of heat is removed and cold water is allowed to flow over the walls of the outside chamber. This cools the chamber and the water again takes up its charge of ammonia gas, producing a vaporization of the liquid ammonia inside of the refrigerator, with a consequent cooling of the brine. The process is then ready to be repeated.

The control of this device is semi-automatic. When the lever at the side of the ice box is raised the source of heat is turned on. If electricity is used a switch is closed by this means. If gas is the source of energy, a valve is opened, and the burner under the tank is lighted from a pilot flame. When the tank is heated enough to drive off all the gas from the water, a thermostat releases the weight of the lever, which then falls, shutting off the source of heat and starting the flow of condensing water. We, therefore, have a definite amount of refrigeration for each lifted weight of the lever. Each operation of the device is actually equivalent to placing so many pounds of ice in the ice box. It is stated that a device of this sort is much cheaper and more efficient than the ordinary type of ice box, but it will probably be some time before we can hear the modern housewife tell the servant, to see if the ice box is lighted, without feeling that something is wrong.

Labor-saving Cleaning Machinery.

With the four labor-saving devices just described, the work of the housewife has been lessened to a great degree, but the multitude of smaller devices have contributed much more to making the life of the housewife easier. The routine housework of the week in the modern up-to-date home has been much simplified. On Monday, the washing is done in a patent washing machine run either by electricity or a small water motor. The clothes are then wrung out in a motor-driven wringer.

Tuesday, the ironing is done not as it used to be with a hot fire in the stove and the sweltering heat of the kitchen laundry, but with cool gas or electric irons. There are also small gas mangles for ironing such things as collars and cuffs at home, so that the modern housewife is no longer dependent upon the steam laundry.

Wednesday, is mending day and the housewife, of course, brings into use the sewing machine, but the sewing machine of to-day is different from that of yesterday; for now it is driven by a small electric motor, the speed of which is regulated by the pressure of the foot and the full set of attachments for the darning of stockings, working button holes, braiding, and embroidering may be used with a machine.

Thursday, is calling or matinee day.

Friday, the vacuum cleaner comes into use, together with the dustless dust cloths which are just beginning to appear. The silverware is also polished by means of a small electric motor.

Saturday, is baking day, and the new aluminium cooking and baking utensils are used in conjunction with the gas or electric stove.

Then follows Sunday, the day of rest.

The End of the Oldest Newspaper in the World

THE president of the Chinese Republic, Yuan Shi Kai, recently suppressed the newspaper King-Pao, which undoubtedly was the oldest paper in the world. For 1,500 years it has reported the most important news not only of China, but also of foreign countries. At a time when the art of printing and journalism was as yet unknown in Europe, the Chinese Tong-Chang invented a means for making types from [illegible] and stone, and in the year 400 A. D. the paper King-Pao was printed, and has since been issued regularly until recently. The first edition was printed on very thin [illegible] silk, neatly tied together, and was then sent to all the high officials of the Chinese Empire.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A New Method of Working Controls to Escape Accident in a Spiral Dive

To the Editor of the SCIENTIFIC AMERICAN:

I have read with considerable interest the letter of [illegible], as well as the editorial inspired by the same, in a recent issue of the SCIENTIFIC AMERICAN.

While gyroscopic force is a danger not generally recognized by aeroplane pilots using Gnome motors, I do not believe that it was that force which caused Paul Peck's fatal accident. Spiraling to earth in small circles was a feat that Peck frequently indulged in, and it is doubtful if any other American aviator was more proficient at this than he.

Once, at Mineola, the writer saw him drop fifteen hundred feet while describing but three circles of about one hundred feet radius, and then suddenly straighten out when only fifty feet from the ground, and land perfectly. Many times he had been warned against this spectacular flying, but he delighted in it, and claimed that, while spiraling, there was absolutely no danger of his losing control of his machine.

As practically all of his flying had been done with a Gyro revolving-cylinder motor, surely Peck would have noticed it if any gyroscopic force had manifested itself at any time during any of the many spiral descents which he made. As a matter of fact, the only time at which this force acts to a dangerous degree, is when an aeroplane moving in a straight or curved course is suddenly twisted about to right or to left. This sudden deviation from its course need be through only two or three degrees, but it instantly reacts, causing the machine to turn upward or downward with such suddenness that, in the latter case, the aviator is flung from the machine like a stone from a sling. John B. Moisant at New Orleans, and W. A. P. Willard (Miss Quimby's passenger) at Boston, are examples of this action. A sudden twist may be given the aeroplane in several ways, such as the pilot's foot slipping off of the tiller, or the breaking of a control wire, or upon entering an "air hole" or pocket. Under these conditions, for the moment, the pilot is perfectly helpless, but if he is securely strapped in his seat, he has a chance of recovery. With the 100 horse-power, 14-cylinder, revolving motors that are now being used, the reaction may be so intense as to break the fuselage in two.

Mr. Brooks's idea that, as the result of a sudden dip of Peck's aeroplane, gyroscopic force caused the aeroplane to tip to one side and spiral, is entirely erroneous. The converse of the action mentioned above by me is that a sudden dip would turn the machine to the right or to the left; but there is no way in which it could be tipped to one side or the other, and caused to spiral by the gyroscopic force.

In all probability the true explanation of Paul Peck's accident is that he passed the limit of safety in both turning and banking, while making one of his famous spiral dives, and was unable to straighten out his machine again before he struck the ground.

Recently, in *Flight*, Lieut. Parke, of England, described how he and a companion, while doing a spiral dive, found the banking becoming steeper and steeper and the dive ever more abrupt. Despite the warping of the wings to the limit to stop the tipping, and the turning of the rudder inward toward the center of the circle, and of the elevator upward to make the machine rise, movements customarily made when spiraling, the machine was evidently completely out of his control and both men believed themselves doomed. When about fifty feet from the earth, Lieut. Parke accidentally turned his vertical rudder in the opposite direction, outward instead of inward, and instantly his biplane came out of the spiral and sailed off on a level keel. Mr. Brooks's three witnesses who saw Peck's rudder turned outward, would indicate that this young flyer had heard of, and did apply Lieut. Parke's remedy for an uncontrolled spiral. But if it worked in one case, why did it not work in the other? The reason no aviator saw the rudder turned outward may be that the rudder was not so turned. It is well nigh impossible to determine, except by a photograph, how the rudder and elevator are set on a fast spiraling aeroplane. Further proof that Peck did not turn his rudder outward is the fact that Roland Garros has found that in spiraling with a Blériot monoplane, it is necessary to turn the rudder outward and the elevator downward in order to recover. With Garros and Lieut. Parke in agreement as the movements of the controls necessary to be made in this emergency, it seems practically certain that young Peck did not make these movements, or at least that if he did [illegible], he did not make them in time to prevent the accident.

Finally, gyroscopic force should not be used to explain accidents in which it cannot possibly have acted.

New York. STANLEY Y. BEACH.

Determinism v. Freewill

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 31st C. H. K. quotes Dr. Johnson as saying: "Sir, we know our will is free and there's an end on't; all theory is against the freedom of the will, all experience for it."

That was just like the good old Doctor, but would it not have been about as logical for him to have said: "Sir, we know the sun goes around the earth and there's an end on't; all theory is against the old belief, all experience for it?"

Let us first get clear on this supposed antagonism of Theory and Experience. In a strict and scientific sense experience represents the source of all our knowledge and the foundation of all truth, and when a theory is shown to be at variance with experience it is abandoned or modified, but in the general use of the word experience may be said to be also the source of all our errors and illusions. It often happens that theory is true and that experience, so called, is false or misleading. When a theory is a logical deduction from a proven law, then the "experience" which is contradictory stands for correction, because it really conflicts with the vast and verified experience upon which the said law is based.

This apparent paradox is of course due to our confusion of experience and inference. For instance, the destruction of matter was a daily "experience" until science proved it an impossibility. Now we understand that only the disappearance of matter was the real experience, destruction was an incorrect but common inference.

This act of discriminating between our actual experience and what is really inference is not always easy, but it becomes a habit with the philosopher; it is a distinguishing trait of the scientific mind, and it is a mental exercise that is much more commendable than it is common.

Now the Determinist takes the position that his doctrine is an exact logical deduction from an established law, namely, the Persistence of Force, or the law of Cause and Effect, as most of us call it, the most fundamental of all our accepted generalizations; therefore, if he is correct, it accords with universal experience; and he points out, as I believe Schopenhauer suggested, that the apparent freedom of the will is an illusion due to our consciousness of the emotional processes which result in decision and action—a self-consciousness which is, at most, very superficial.

The Determinist further argues that his doctrine accords more directly with experience. People act in the same way under the same circumstances, or, when they do not, we say that some are "differently constituted," which is only saying that the circumstances are different. Otherwise there could be no social order. Political, commercial, and financial systems are evidences for Determinism.

Freewill would be psychical Chaos. It is, in fact, unthinkable. Determinism is at least conceivable. It is recognized in our laws and customs. It pervades our every-day speech. "We do as we *will*, that is as we *wish*;" yes, in fact we do nothing else. When we act, as we say, contrary to our desire, we mean only that a greater or higher desire than any which first swayed our minds is acting within us. We expect no heroism from one who has not "got it in him." If we are sometimes surprised and proven to be wrong, we admit our mistake and apologize. We can conceive of no sane person doing anything without a reasonable *motive*. The entire absence of reasonable *motive* is accepted by us as *prima facie* evidence of insanity—and there we are still acknowledging Determinism.

Will, in practice, may be said to be the algebraic sum of the various desires involved. Action, inaction, or adverse action follow as the resultant "sign" is positive, neutral, or negative.

It is not necessary that we explain all the strange aberrations of the individual mind or the many seemingly unaccountable acts of man, any more than it is required of us that we explain in detail the interminably varied and involved movements of a running brook in order to substantiate the law of the Persistence of Force or Continuity of Motion in the physical world.

There is one question which the advocate of Freewill will immediately ask, with the air of making a poser for the Determinist; "What about moral responsibility? There could be no moral responsibility according to the deterministic postulate, therefore our system of administration of justice is all wrong. Why do we punish the wrongdoer?" The answer is so obvious that it seems awful to have to repeat it: We are only doing the best we can. We are following our hereditary impulses, the instincts which so far have served very well, considering, and we must continue to follow them until we can do better.

As we grow in knowledge we will substitute a more scientific method than that of stimulating fear in order to deter men from vice and crime, a crude and unsatisfactory method at best. As we become more scientific, our administration of justice will merge into a prevention of injustice. Our corrective methods for social evils will become more rational and more efficient, and nothing is doing more to prepare men's minds for the acceptance of this much-to-be-desired social plan than the spread of the doctrine of Determinism. It underlies every real advance made in educational methods and the spread of social welfare.

To paraphrase Prof. Jacques Loeb in a recent article in the *Popular Science Monthly* upon the mechanistic as compared with the vitalistic conception of life: When even the advocate of Freewill wishes to contribute anything more valuable to us than mere argument or rhetoric, he proceeds upon the assumption of Determinism.

Where the adherent of the doctrine of Freewill in practice has neglected or ignored the facts, trusted to chance or Providence, exiled, persecuted, maimed, and murdered the children of men—and failed—the Determinist in practice will study the facts, readjust conditions, forestall degeneration, nourish, train, and succeed.

Determinism is only one phase of that simple Faith which grows stronger with every advance in knowledge and which is the guide and inspiration of the scientific investigator in every field—the belief in the Uniformity of Nature. J. E. STINSON.

Wichita, Kan.

The Rail Problem

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 10th, 1912, I read that a Public Service Commission has pronounced excessive speed as the cause of broken rails on our railroads.

It looks very much like an acknowledgment of defeat on the part of our engineering experts, if this failure cannot be prevented except by reducing speeds—a means of last resort.

Is it not possible that they have been looking for the fault in the wrong place? This fault may be in the rails, the roadbed or the rolling-stock. The first two places have been probed, and many faults found and corrected, but still the rails continue to break. But, as regards the rolling-stock, I do not believe that a single change has been made or suggested, with a particular view to prevent the failure in question.

Reducing the weight of the rolling-stock would also be an acknowledgment of defeat by engineers and inventors, and should not be considered so early in the game.

If attention be directed to the rolling-stock, it is at once noticed that the load of the train is very unevenly distributed over the rails, through the medium of the trucks or wheels. The load should be so distributed that the rails, when once loaded, would not be relieved until the last pair of wheels of the train had passed.

Under the present manner of distribution, the rails are alternately loaded and unloaded, as the wheels pass over—once fully or twice partially—in the passage of each individual car in the train. This involves repeated bending of the rail, which must tax the fastenings, and ultimately cause a weakening and breaking of the rail, because of crystallization.

To carry out this suggested change, it would be necessary to build shorter cars and increase the wheel-base of the trucks. Instead of shorter cars, however, an additional truck could be provided, which would be placed midway between those as they are at present, disposed at either end of the car. To provide for rounding curves, the flanges could be left off these additional wheels or provision made for lateral movement.

With this reconstruction, the individual pairs of wheels throughout the entire train would be equally spaced and a perfectly uniform distribution of the load obtained; and instead of subjecting the rails to repeated shocks, during the passage of a long train, this would be reduced to unity—or the fluctuations rendered so light as to be harmless.

Chicago, Ill. C. W. EISENMANN.

A Plan for Utilizing the Sahara Desert

To the Editor of the SCIENTIFIC AMERICAN:

I was very much interested in your recent article, "Converting the Sahara Desert into a Sea," and from the description given of the engineering features, it seems to a "rank outsider" that instead of making a great inland sea it would be far better to make a series of irrigation and navigable canals and possibly small lakes in low areas in which the quantity of water could be regulated to a nicety by gates or locks in the intake canal, as well as with others along the line where needed.

This would not cover up hundreds of thousands of acres of the best and most fertile land, and the smaller quantity of water would not disturb the "earth's equilibrium" nor be a danger of making climatic changes in Europe, both of which were mentioned as objections to the "Inland Sea" plan.

Wheeling, W. Va. W. P. MEGRAIL, M.D.

Labor-saving Duplicating Machines for the Office

A Review of Methods Old and New

By H. S. McCormack

The requirements of business have made it necessary to devise quick, cheap and successful processes for duplicating handwriting and typewriting. In the last twenty-five years the number of duplicating devices has multiplied until it would seem that every need of the office is supplied. And yet duplication in a business sense is still in its infancy. Much remains still to be done. The following article, written by a well-known expert on business efficiency and office management, describes briefly the principal duplicating machines now in use. As a review of the state of the art, his article may suggest to others improvements which are still needed.—EDITOR.

ASK a dozen business men what in their opinion is the best duplicating machine on the market and you will probably receive a dozen different replies. Each business man is invariably guided by his own experience. If the man to whom that question be put happens to be a railroad man, he may recommend the mud duplicator, because in his department the duplicator he recommends is possibly the best of all.

The "mud duplicator" is known to the trade by the more refined name of the "clay process," and is furnished usually in metal trays, but in some of the steel mills and railroad offices the "mud" or "clay," as it is called, is purchased in bulk, usually in kegs.

When purchased in bulk the clay is spread out on tables to the thickness of one half or three quarters of an inch, the table being fitted with an inch beading around the edge, but it must be understood that in most such "copying offices" good clothes are unknown.

This clay material resembles putty to some extent and has about the same consistency, while the color is not unlike that of putty.

How the "Mud" Duplicator Works.

After being spread out on the flat surface a wet sponge is used to moisten the clay; after which the sheet to be copied is applied, face down, to the clay. The document to be copied or duplicated has previously been prepared with either duplicating ink or a duplicating ribbon; consequently, when the document is laid flat and rubbed gently down on the smooth surface for the purpose of eliminating wrinkles and air spaces, the damp clay receives the impression.

The paper is left for a minute or two and is then pulled off. Upon the surface of the drab colored clay is the inked formation of the work to be duplicated.

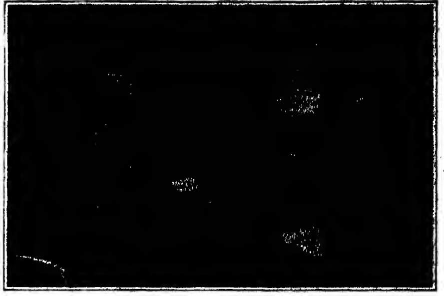
Immediately after the original copy has been removed, fresh plain sheets are applied quickly and smoothed out, usually by hand, and are immediately pulled off. Thus a few good legible copies are secured. Now the moistened sponge is brought into play, and all trace of the copy is washed off and a new copy is stamped on immediately and the operation repeated.

For securing from three to six or eight copies of a shop order or for securing copies of way-bills, etc., the clay process has the advantage of being inexpensive and very rapid and, although an old process, there has been nothing found that would quite take its place for quick and inexpensive results.

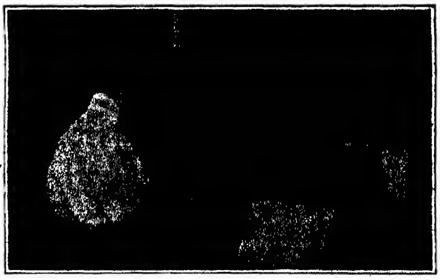
The Gelatine Pad.

Following the "clay process" came the "gelatine pad," or the little tin trays or jelly cake tins in which was poured a gelatine composition, which was a very clean and refined method for securing a few duplicate copies. A great many companies sprang into existence and began to furnish gelatine copying pads, with the result that thousands of gelatine tins were sold to business firms all over the country, but the best known process was the old "hektograph," which is still in existence. Despite the wonderful strides made in the art of duplicating, there remains to-day a certain demand for duplicating work of this character.

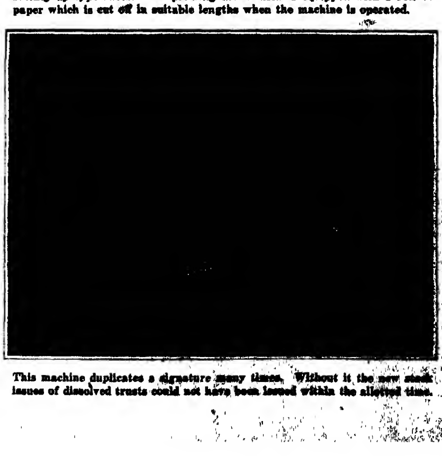
Then came the typewriter, followed by typewriter carbon copies. The results of the first carbon sheets were anything but satisfactory, and it is hard to-day to realise how mussy and smudgy were the carbon sheets at the time the first typewriters were introduced. Soon improvements were made in the carbon paper. Then came the hektograph typewriter ribbon, which smeared up the operator, the office boy, and sometimes ruined the disposition of the "boss." Finally the art of manufacturing the proper ribbons was learned with quite satisfactory results.



With the mimeograph copies are produced in large numbers of such a character that they can be successfully used for circularizing.



An inventor has designed this machine to provide a mechanical means of setting up type faces. The printing mechanism is equipped with a roll of paper which is cut off in suitable lengths when the machine is operated.



This machine duplicates a signature many times. Without it the new stock issues of dissolved trusts could not have been issued within the allotted time.

About this time the hektograph carbon was introduced, and while the number of legible copies was reduced, the cleanliness of the carbon, as compared to the ribbon, was an element in its favor.

Next came the wax stencil sheet. In this connection the history of A. B. Dick, who was engaged in the lumber business at the time, is interesting in itself, as he was the pioneer user of the wax principle, and his highly perfected wax sheet and ink supplies will go down in history, now that the Dick-Henry case has stirred up the country and the press, and seems likely to result in some far-reaching legislation.

How the Wax Stencil Sheet Duplicates.

The stencil, as now used in the process of duplicating autographic work, is made on a sheet of fine, specially manufactured tissue paper coated on one side with a film of wax or very sensitive material.

The cutting agent of the mimeograph is a plate of fine tool steel upon which are cut intersecting corrugations numbering two hundred to the inch, thus making on the plate a surface of small sharp points, so fine and minute that a magnifying glass is required to bring them distinctly to the eye.

Upon this steel plate (which is embedded in a table of polished slate) the sheet of sensitive paper is placed, and the stencil is formed by writing on the paper over the steel plate with a fine-pointed stylus which is made of tempered steel. As this stylus passes over the sensitive paper, it presses it against and upon the steel plate, and the fine sharp points puncture it from the under side, making a series of orifices or holes, each one a two hundredth part of an inch from the next, in the lines of the writing. The point of the stylus, although tapered to the size of a nicely sharpened lead pencil, really rests on three of the cutting points of the writing plate at one time. It thus glides easily and smoothly over the roughened surface without tearing the paper, but still with just enough friction to make the act of writing a pleasant operation, almost identical with that done by a medium hard lead pencil.

With the advent of typewriters, experiments were first made with sand-paper behind the wax sheet, and then emery cloth; but the attempts were very unsatisfactory until the present method was discovered, i. e., the use of a sheet of specially prepared stencil paper (made from open woven Japanese fiber similar to a lady's veil), back of which is placed a piece of very fine bolting cloth or open fibrous paper, both being inserted in the typewriter and written upon in the same way as an ordinary letter is produced, with the exception that no ribbon whatsoever is used.

The stencil is made by striking the type against the stencil sheet, and in doing this the wax coating is driven from the stencil sheet into the bolting cloth or fibrous backing in the lines of the characters so struck; in other words, the typewritten stencil is made by removing the wax coating from an open fibrous material where the type has struck.

The mimeograph was the first duplicating system which produced copies in sufficient numbers of a grade which gave them a commercial value for circularizing purposes.

While the mimeograph was going through its early stages of development there was brought from the other side a gelatine roll of German manufacture.

[illegible] was in this [illegible] present [illegible] and [illegible] of copy- [illegible] the [illegible] were [illegible] on a gelatine [illegible] it could be rolled along and fresh [illegible]ies supplied, whereas, with the tin tray, [illegible]e material could not be used again for [illegible]enty-four hours, or until the gelatine [illegible]d absorbed all the ink.

The old-fashioned copypress had, with [illegible]e advent of the typewriter, become more [illegible]pular than ever. Now came a demand [illegible]r the big presses. The railroads used [illegible]rge sheets of tissue and secured a dozen [illegible]pies at a time, but there was a demand [illegible]r a larger number of copies and for [illegible]tter copies, with the result that numer[illegible]s inventors were striving to supply the [illegible]ed.

The Typewriter Duplicator.

Finally, the type duplicator was introduced. This was really a portable printing press composed of a flat bed with a [illegible]ll or platen running over the printers' [illegible]ase, which was filled with the regular standard printers' type. The advantage [illegible] the outfit was mainly that it was [illegible]uipped with a typewriter ribbon; consequently, the impression secured was a [illegible]od imitation of typewriter work.

This attempt at duplication was followed by type lined up in cylinders, [illegible] metal drums, and these little types, w[illegible] their different faces, were in groov[illegible] channels opposite a revolving typehold[illegible] which permitted the type from the s[illegible]ply drum to be set up in letter fo[illegible] When a letter form was completed a r[illegible]bon was stretched over the whole a[illegible] the handle turned, with the result t[illegible] duplicate letters were turned out [illegible] wholesale quantities.

Then came a demand for a fewer nu[illegible]ber of copies—one copy of a document [illegible] instrument—in some cases, two copi[illegible] This was especially desired by insura[illegible] companies where it was customary to co[illegible] original insurance applications by ha[illegible] Insurance companies found it necessa[illegible] to copy insurance applications for use [illegible] adjusting or contesting cases, but the s[illegible]tem of copying by hand was cumberso[illegible] full of delays and expensive, while t[illegible] errors in copying resulted ofttimes [illegible] considerable loss.

Making Duplicates by Photography.

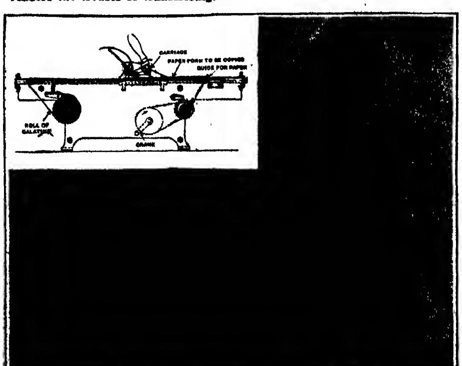
This demand brought about a pho[illegible]graphic method, or a self-contained pho[illegible]graphing outfit, which reduced the cost [illegible] copying by hand and produced in a f[illegible] minutes, instead of a few hours, a tr[illegible] copy of the original papers.

(Concluded on page 310.)

A flat-bed type of duplicator using foundry type, electros, etc., of standard size. These machines provide means for duplicating typewritten letters or for printing forms in business offices.

This remarkable photographic device delivers within a few minutes a duplicate of a design or drawing. It photographically reproduces a piece of machinery or a sample cartoon or supplies a photograph of a new lace curtain. Libraries use it extensively for copying whole pages of books to save readers the trouble of transcribing.

The multigraph is an instrument which duplicates by means of type lined up in cylinders or metal drums, which little types, with their different faces, lie in grooved channels opposite a revolving type holder. A ribbon is stretched across the completed letter form, a handle is turned, and duplicate letters are turned out in large quantities.



A duplicator that makes from one to seventy-five copies from one master sheet.—The machine itself consists of a rigid frame supporting a flat steel bed, over which travels a sheet of highly absorbent gelatine. By means of a feeding carriage the original or master sheet is brought in contact with the gelatine band, which takes an exact impression of the written matter; then by feeding blank sheets in the same manner, copies are produced. After one portion of the 14-foot band is used, a new surface is obtained by turning a handle which automatically winds up the used surface as well.

A combination letter-writing and addressing machine.—The machine automatically produces complete typewritten letters, each with a different name and address—together with the proper salutation—in one operation. The complete letter is printed through a single ribbon—so that the "match" is absolutely perfect. The machine can be equipped with an automatic skip attachment permitting the skipping or printing of any combination of lists up to eight classifications. Both segments and address plates are set up by means of a rapid automatic typesetter.

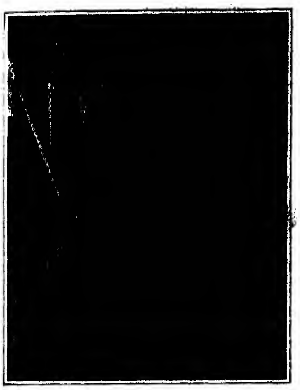


Fig. 1.—Drilling thirty-two holes simultaneously.

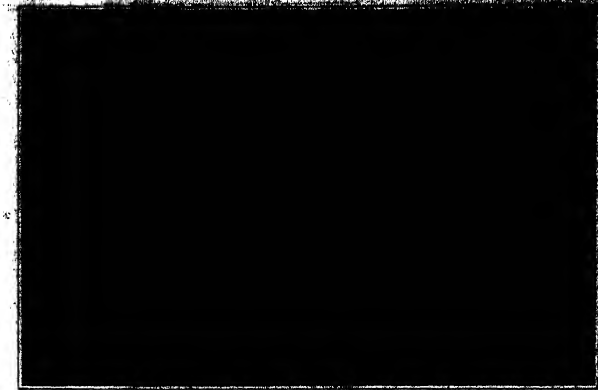


Fig. 2.—Four crankcases are machined in a single movement of the bed on which they rest.

Labor-saving Devices That Produce Automobiles

Multiple Production and Its Influence on Automobile Prices

By Theodore M. R. von Keler

THE first step in sending the automobile-to-be on its winding path through furnaces, lathes, drills and stamping machines naturally is the purchase of materials. This work is handled by the purchasing department, where a system of records is kept which allows instant determination of the exact time when the parts or materials ordered are due to arrive at the factory. If there is any hitch in the shipping from the manufacturers of raw materials, "chasers" are sent to them and things are "hustled" along. A "chaser" is a man whose sole duty it is to take hurried railroad trips to the tarrying establishments and to impress upon their managers in as forcible a manner as possible the necessity of "getting a move on."

The steel ingots, sheets, wood wheels, "live" axles, ball and roller bearings and all the other thousand-and-one large and small bits of metal and wood having been received, the future automobile begins to rise out of the chaos, not in a single unit, but in lots of a thousand or more. At one end of the huge factory an immense drop forge gives a few "loving taps" to an unwieldy steel bar, and lo! a side frame member of the chassis is born. Another forge close by, at the same time, turns out end members, and before you realize it, there are a dozen or more complete chassis frames standing alongside of you.

A little farther down the line of huge machines there stands a big forge which by a single blow turns out a front axle for the car-to-be, the steel bar, of course, having been treated before it reached the machining shop. And so on and on. Everywhere stand whole batteries of machines which do nothing all day long but strike a terrific blow every minute or so, or which lift a part to be machined against a multiple drill, the man in charge being so expert in his particular duties that he barely casts a glance on his work now and then. The machines work automatically and with the least amount of energy to the attending operator.

Take for instance the multiple drilling machine shown in Fig. 1. In a single upward movement of the table on which the crankcase rests, thirty-two holes are drilled simultaneously in less time than it takes to drill a single hole in an ordinary machine from a center punch mark. The casting itself is held securely in a special jig, in such a position as to force the drills to pass between steel bushings spaced with absolute accuracy. The operation of drilling the thirty-two holes, besides requiring only 1/32 the cost and time of machine shop methods, is far more accurate.

Fig. 3.—How crank cases are bored for cam-shaft bearings. Accurate alinement is secured by means of a jig.

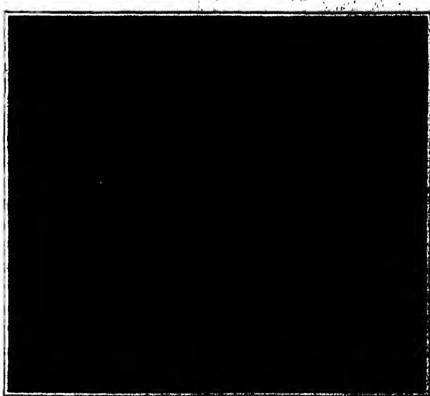


Fig. 4.—A set of four cutting tools works simultaneously on a flywheel. By a single movement the operator can bring into use other sets of tools, ready clamped in the pivoted arm, the entire operation of finishing a flywheel taking but a few minutes.

Similar drilling machines drive holes through the frame members and transmission cases, in sizes varying from 1/8 of an inch to 6 inches diameter. All of them are automatic or semi-automatic and are accurate to the 1/1000 part of an inch.

A little farther on one sees a huge machine which at one time performs three operations on ten different sets of cylinders. The milling on this machine is the first operation on the rough cylinder castings, as they come from the foundry. Another big machine, shown in Fig. 2, illustrates how four crankcases are machined in a single movement of the bed on which they rest, while Fig. 3 shows how the crankcases are bored for camshaft bearings and how accurate alinement is secured by means of a jig.

One is involuntarily reminded of a cannery in which fruit is canned, when one sees the huge "paring" machines at work. There is one that silently, and yet irresistibly, shaves steel from a rough camshaft forging as easily as one would pare an apple, and nearly all of them work with so-called "gang jigs," that is to say, they machine several pieces at one and the same time. An example of this kind of machine is shown in Fig. 4, where a set of four cutting tools starts work simultaneously on a flywheel. By a single motion of the operator's hand other sets of tools, ready clamped in the pivoted arm, can be brought into use, the entire operation of finishing a flywheel taking but a few minutes.

Far more complicated, and therefore more interesting, are the gear-cutting machines which turn out the finely beveled gears for the transmission and driving gears. From a solid chunk of steel fed into them they cut with more than human accuracy the finished bevel gear.

A machine of a different kind may be seen at one end of the big plant. It is an electric welding machine, and surely is as near being magical as a machine can be. The fender irons, being sharply [illegible]

[illegible] ... in perfect [illegible].

But [illegible] the more [illegible] manufacturing of the [illegible] parts is, it is useless to turn out [illegible] finished parts in a few [illegible] at but a single operation unless these parts are perfectly made. And while the milling, drilling and cutting machines are wonderfully accurate, the motor car builder of to-day takes no chances with their infallibility In another room, adjoining the big machining department, he has machines which like nothing better than to find fault with the work of their big brethren. There are, for instance, gages and balances for testing cylinders and pistons, which reject automatically any and every piston found defective or light, be the imperfection ever so slight A piston weighing but a few grains more than its "partners" in a four- or six-cylinder motor may seriously interfere with the smooth working of the engine

There are still more accurate gages used for testing ball and roller bearings. So difficult is the production of these that the bulk of it is carried on in special factories equipped with the most marvelous testing instruments known One of these is shown in Fig 7 and is used for gaging the size and weight of rollers used in roller bearings. The rollers are fed into a horizontal cylinder from which they are sent on an endless belt between the poles of electric testers. When they pass one in which they meet all the requirements as to thickness and weight contact is established, a trap door opens and they drop into a receptacle placed below that particular tester The cans shown below hold rollers of certain sizes and weight, there being sixteen of them on each testing machine

In another machine the hardness of the steel used in wrist pins and other important small parts of the car is tested. This machine is a scleroscope It consists of a graduated glass tube through which a hard steel ball is dropped upon the steel to be tested The ball hits the steel and bounces back into the tube. As it is always dropped from the same height, the degree of its bounce indicates the hardness of the steel.

Crankshafts are placed upon knife-like edges and turned at every possible angle They must remain stationary in any position. If they move the least fraction of an inch they are rejected as imperfect and out of balance The men who do the testing are experts in their line. Supersensitive ears added to highly developed powers of observation enable them to discover imperfections in a motor which the layman could not notice, even after they are pointed out to him. There are men who do one particular operation day in and day out who repeat it a thousand times a day, and perhaps a million times in all before they are promoted to some foreman position. They are specialists in the highest sense of the word.

But all the efforts of the factory, and the very core of the so much desired [illegible] production, as explained before, would be wasted were it not for the highly [illegible] [illegible] and selling department. [illegible] it is one thing to design a machine [illegible] a given number of [illegible] [illegible] but it is quite another thing to so adjust the remainder of the factory and the sales end of the enterprise, to take full advantage of the efficiency of the machinery. The human factor in such an organization is still too large to be ignored, and the administration and selling end of the same are fully as interesting than the mere mechanical production.

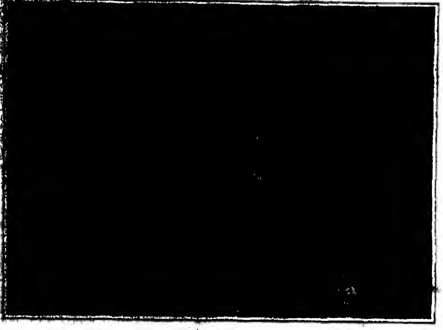


Fig. 5.—A single day's output of motors used in one of the cheapest cars on the market. In order that the consumer may receive a motor that is as perfect as mechanism can make it, it is subjected to the tests of gages and balances which reject automatically any and every piston found defective or light, be the imperfection ever so slight.

Fig. 6.—This is about one quarter of a day's output in wheels for a Detroit manufacturing firm. Like other parts of an automobile, wheels are not only made by the thousand, but are carefully inspected and tested before they are fitted to the axles of the cars which they are intended to support.

Fig. 7.—Testing roller bearings for accuracy in electrical testing machine. The rollers are assorted by the machine, and those of exactly the same size are dropped into one can. There are sixteen cans for sixteen different sizes, varying from one another by only 1/256 of an inch. The largest and smallest sizes vary by only 1/16 of an inch.

Chill-proof Beer

NO subject has engaged the efforts of the brewers in recent years more than the problem of brewing a chill-proof bottle beer that will stay brilliant and retain its original flavor and taste when chilled to low temperatures. Beer is very sensitive, even diffused daylight affecting its taste and color unfavorably. Pasteurisation, while preventing any further fermentation, exerts a detrimental influence on the beer and increases its sensitiveness. Not only light, but also low temperatures affect the beer injuriously. Bottled beer deteriorates in time. If, after ten days to two months, the bottles are chilled by placing them on ice, their contents become hazy or cloudy.

Beer contains from 2.5 to 8 per cent of alcohol, 3 to 6 per cent of carbonic acid gas, and from 6 to 10 per cent extract, including about 0.4 per cent of albuminoids. It was found that the turbidity of the beer was due to a part of these albuminoids, which, on chilling, became insoluble. These albuminoids are of a highly complex molecular constitution, and the sensitiveness of the beer is due to their presence. Bottles made of brown glass protect the beer from the actinic rays of light, but do not prevent haziness on chilling. It may be supposed that the problem was easy of solution by chilling beer almost to the freezing point and filtering. However, it seems that the albuminoids of the beer constantly undergo slight changes, and beer, carefully filtered when cold, will again become cloudy when subjected to chilling a second time.

The problem was attacked from many sides. Efforts were made to modify the albuminoids in the mash tub; by removing as much as possible the albuminoids of the beer; by restricting their introduction in the mash tub. However, since malt contains soluble albuminoids which enter the beer wort, the evil could not entirely be overcome. Furthermore, beer containing few albuminoids deviates from the composition of normal beer; the foam keeping qualities are impaired and it lacks what the brewer calls zest and palatefulness. Neither were special methods of fermentation of any avail

At last the problem has been successfully solved; bottled beer is now put on the market which stays perfectly clear and brilliant even after staying on ice for days and weeks

The solution consists in rendering the albuminoids permanently soluble, in digesting them, as it were, by breaking down the highly molecular albuminoids into lower albuminous compounds, such as albumose, peptones, and amino acids This is done by adding to the beer a minute quantity of a proteolytic enzym, as little as one gramme per barrel of beer being sufficient. Enzyms are organic ferments; they are nitrogenous compounds of complex structure, which by their mere presence are able to effect chemical changes in organic substances without undergoing any change themselves: in other words, they are catalyzers. The study of enzyms is extremely difficult. Enzyms usually occur in mixtures with other enzyms, and it is practically impossible to separate them without decomposition. Boiling, or even lower temperatures, will coagulate them; the presence of traces of certain salts, etc., will inhibit their action, while other salts will energize them. Malt and yeast contain a large number of enzyms, one of which is peptose, a proteolytic enzym, capable of dissolving and modifying albuminoids. In employing enzyms derived from malt or yeast, no substance is introduced into the beer except those derived from the usual brewing materials.

The Imposing Naval Review at New York

The President Reviews Five Miles of United States Warships

THE grand mobilization of the Atlantic Fleet at New York for inspection by the Secretary of the Navy and review by the President of the United States, is the largest and most important gathering in one place of the ships of the United States Navy that has ever occurred. Last year ninety ships were mobilized at New York whose total tonnage reached 576,634. To-day there are gathered in the Hudson River 123 ships of all classes, whose aggregate displacement is 720,480 tons. That the people of New York and visitors from the various States will thus have under their eyes, at one and the same time, practically the whole fighting force of the United States Navy, is shown by the fact that the latest official summary of the displacement of all the ships of the United States Navy gives the total as 758,499 tons. So that the fleet at New York is only about 38,000 tons short of including the whole of the effective Navy.

The five-mile line of ships will extend from Thirtieth Street to a point about a mile and a half above Spuyten Duyvil, at the mouth of the Harlem River. The fleet includes:

	Tons Displacement
31 Battleships	478,508
4 Armored Cruisers	58,000
4 Cruisers	15,563
20 Special Type	55,373
6 Naval Militia Vessels	4,581
8 Fuel Ships	88,385
24 Destroyers	16,947
16 Torpedo Boats	3,029
10 Submarines	...

The object of the mobilization and review is two-fold. First It is the hope of the Navy Department that the gathering of so many ships of various types will stimulate the interest of the public in the Navy, and that it will give the many thousands of visitors who will go aboard the ships that more intimate and intelligent knowledge of the quality of our Navy, which can be obtained only by a personal inspection of the vessels themselves. Printed descriptions and published photographs can do much in the way of instruction; but far more can be effected by gathering the fleet in one great assemblage, and giving the public every facility to inspect the ships in person. That these reviews fulfill this purpose was proved last year, when it was estimated that many millions of people, not only from New York but from far distant sections of the country, flocked to the banks of the Hudson River to witness the imposing spectacle, and crowded the excursion boats, which took them to the ships or steamed up and down the long lines of anchorage. The second object of the mobilization is to train all the branches of the Navy in co-ordinating and perfecting the many details of preparation, which are involved in the mobilization of such an impressive force.

To those of us who have followed the growth of our new Navy with close attention, it is evident, at a glance, that the long line of warships includes representatives of every year of growth of our new Navy from the date of its birth in the early eighties. The array is so distinctly historical, that there may be found in it representatives of every shipbuilding programme from the time of the famous White Squadron down to the present year.

Thus, among the battleships, we find the "Indiana" and the "Massachusetts," which, with the "Oregon," now on the Pacific Coast, formed the first group of battleships to be built for our Navy. When they appeared, the world was startled by the great weight of their armament, which included four thirteen-inch, eight eight-inch, four six-inch and many smaller rapid-fire pieces. Following them came the "Iowa," which mounts four twelve-inch and eight eight-inch guns. Present at the review, also, are the "Kentucky" and "Kearsarge," which were commissioned just after the Spanish war. These ships carry four thirteen-inch guns, with four eight-inch superimposed above them—these vessels being the first of our ships to carry the double-deck turret. Next in order of age are the "Alabama," "Illinois" and "Wisconsin," the last of our ships to mount the thirteen-inch gun, of which each ship carries four. In them the eight-inch gun disappeared and its place was taken by a battery of fourteen six-inch guns, mounted in broadside. Next in historical order are the "Maine," "Missouri" and "Ohio," enlarged "Alabamas" with four twelve-inch and sixteen six-inch guns. The two classes are readily distinguished by their smokestacks, the "Alabamas" being the only ships in our Navy to carry their smokestacks abreast—an English custom of the period in which these ships were built. The "Maine" class has three smokestacks on the center line.

Next in date among the battleships at the review are the five vessels of the "Georgia" class, i. e., "Virginia," "New Jersey," "Georgia," Nebraska," and "Rhode Island." These vessels mark a great advance in size and fighting power over the "Maine" class, and the eight-inch gun and the double-deck turret reappear.

It may be well, just here, to note the increase in size from the "Oregons" to the "Georgias." The "Oregons" are of 10,288 tons displacement; the "Iowa," 11,410 tons; the "Kearsarge" and "Kentucky," 11,500; the "Alabamas," 11,552; the "Maines," 12,500; and the "Georgias" about 15,000 tons. The "Indianas" were completed in 1895 and the "Georgias" in 1905. There was thus an increase of 50 per cent in the displacement of our battleships during the first decade of the new navy. The "Georgias" carry four twelve-inch guns in two turrets forward and aft, with two eight-inch superimposed. On each beam is a turret containing two eight-inch guns, and there is a secondary battery of twelve six-inch rapid-fire guns. These ships are heavily armored, and they are good to-day for a maximum speed of 19 knots.

The "Connecticut" class, which followed the "Georgias," is the last of the pre-dreadnoughts era. The "Connecticut," the flagship of Admiral Hugo Osterhaus, Commander-in-Chief of the Atlantic Fleet, was the first of six ships—the "Connecticut," "Louisiana," "Kansas," "Vermont," "Minnesota" and "New Hampshire." They were completed in 1906 and 1907. They are of sixteen thousand tons displacement, and in recent sea trials have made from [illegible] to [illegible] knots. The battery consists of four twelve-inch, forty-five caliber guns in two turrets fore and aft, eight eight-inch forty-five caliber in four turrets on the broadside, and twelve seven-inch fifty-caliber guns disposed in a battery amidships on the gun deck.

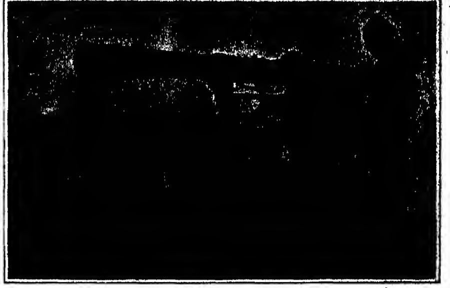
Smaller editions of the "Connecticut" are the "Idaho" (present at the review) and the "Mississippi," which is just now in drydock having her machinery overhauled. Congress and not the Navy is responsible for the fact that these ships are of only 13,000 tons and have the low speed of only seventeen knots. Congress restricted the displacement to thirteen thousand tons, and the Department decided that it would be best to build smaller editions of the "Connecticut," reducing the speed and coal supply, and cutting out four of the seven-inch guns.

With the "South Carolina" and "Michigan" completed in 1909, our Navy entered its dreadnought era. These vessels, of 16,000 tons, are armed exclusively with twelve-inch guns. They carry eight of these in four turrets, two forward and two aft, on the longitudinal center line of the ship. The inboard guns fire above the roofs of the outboard turrets, and all guns are available on either broadside. This principle of mounting, first introduced in these ships, has become practically universal throughout the world. In their recent speed trials at sea the "South Carolina" made 19.68 knots and the "Michigan" 20.01 knots.

In the next class are the "Delaware" and "North Dakota" of 20,000 tons, completed in 1909, and the "Utah" and "Florida" of 21,825 tons, completed in 1911. These four ships mount ten twelve-inch forty-five caliber guns in five turrets, all placed on the center line. The broadside fire consists of ten guns and the forward and aft fire of four guns. The torpedo-defense battery consists of fourteen five-inch guns in the "Delaware" and "North Dakota" and sixteen of the same caliber in the "Utah" and "Florida." The former have recently made over 22 knots on their regular annual speed trials. The "Florida" made on her trials over twenty-one knots and the "Utah" over twenty-two knots.

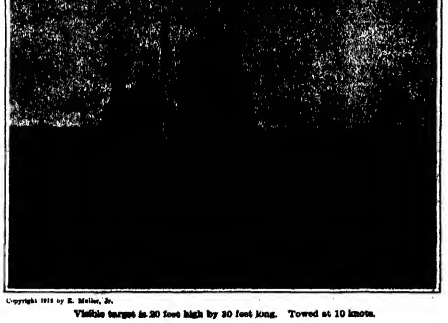
The most interesting ships at the review are, naturally, the "Arkansas" and "Wyoming." They are our latest dreadnoughts, recently completed; they have the large displacement of 26,000 tons, and they are the first of our ships to mount twelve twelve-inch guns. These are mounted in symmetrically-disposed pairs of turrets, with one pair of guns firing above the roof of the adjoining turret. Two turrets are forward on the forecastle deck, two immediately abaft the mainmast, and two on the after part of the quarter-deck. These twelve-inch guns are fifty calibers in length, and have higher velocity and more penetrative power than the forty-five caliber guns of the "Utah" and "Florida." The secondary battery consists of twenty-one five-inch, fifty-caliber guns. The designed speed of the ship is 20.5 knots, the coal capacity is 2,500 tons, and 400 tons of oil are carried. A novel feature in these ships, which to our thinking adds greatly to their appearance, is the fact that there is no break in the sheer line of the upper deck, which astern has a freeboard of about 19 feet, and runs with a gradual rise to the stem, where the freeboard is between twenty-five and twenty-six feet. One advantage of this arrangement is that the broadside battery of five-inch guns is carried several feet higher above the water line than in the preceding vessels, which have a straight sheer and raised forecastle deck.

Next in interest to the battleships is the torpedo fleet, which is represented by 24 destroyers, 16 torpedo boats and 10 submarines. Our destroyers are fast, seaworthy boats, of 750 tons displacement. The latter



When instrument is focused, range is shown on a scale.

Range finder, mounted on turret roof.



Visible target is 20 feet high by 30 feet long. Towed at 10 knots.

Target used in battle practice.

Displacement, 21,825 tons. Speed, 22 knots. Coal, 2,500 tons. Guns: ten 12-inch, sixteen 5-inch. Belt and turret armor, 11 and 12-inch. Driven by 4-screw Parsons turbines

Battleship "Utah;" sister ship is the "Florida;" both in the Review.

boats have a raised forecastle deck with a freeboard of sixteen feet. They are able to go anywhere on the high seas and endure the severest weather. The newest three and four-funnel boats of the "Patterson" and "Sterrett" type are good for from thirty to thirty-three knots.

The submarines are of the well-known "Holland" type, and perhaps no branch of the navy just now excites greater interest among the naval officers than the submarine service. Looked at askance a few years ago, the submarine is now regarded as a formidable arm of the service, the limit of whose possibilities in future warfare, when it shall have grown in size, speed and sea-keeping ability, it is difficult to determine.

Mention should be made of the division of four armored cruisers, which includes the "Tennessee," "Montana," "Washington" and "North Carolina." These are identical vessels of 14,500 tons displacement and over 22 knots speed. Completed 1907 and 1908, they represent a type of which no modern representatives are being built. Their place has been taken by the modern battle-cruiser, a ship exceeding the battleship in size, and from five to seven knots faster, possessing somewhat less gun power and less heavily armored, but still a vessel capable of lying in the first line of battle. We have none of this type of ship in our Navy, none is being built, nor as far as we know, has a battle-cruiser design been drawn. The "North Carolinas'" battery of four ten-inch and sixteen six-inch guns, and their light armor of five inches maximum thickness, renders them totally unfit to cope with the modern battle-cruisers which mount twelve and thirteen-inch guns and carry from seven to nine inches of armor.

In concluding this description of the ships present in this imposing review, we wish to express our belief that ship for ship and date for date, our vessels are fully the equal of, and in battery power the superiors of the average fighting ships of the same classes in the navies of to-day. Particularly powerful is our battleship fleet in gun-power. We believe that the vessels of the "Connecticut" and "Georgia" classes are more than a match for the pre-dreadnought ships of other navies; indeed, because of their heavy armor, they would be able to lie in line against any of the twelve-inch gun dreadnoughts of foreign powers.

The weak points of the fleet that lies in the Hudson River, if there be any, are its lack of battle-cruisers and a sufficiency of torpedo boat destroyers. Naval experts consider that there should be four destroyers to each battleship. Taking the effective battleship fleet of the first line at, say, twenty-five ships, we should have one hundred of these craft in the Hudson instead of the twenty-four that are in commission.

The New Parisian Telephone Exchange

IT is now four years since the central or Gutenberg telephone exchange at Paris was entirely destroyed by fire, and after that a temporary exchange was installed while waiting for the reconstruction of the building. At present the new exchange is erected and the apparatus is commencing to be installed. The new building is a handsome one, and is built on the site of the old one, next the central post office, but the somewhat narrow space due to the position of the ground is made larger by adding an overhang in reinforced concrete, so that the main halls on the different floors are no less than 210 by 36 feet.

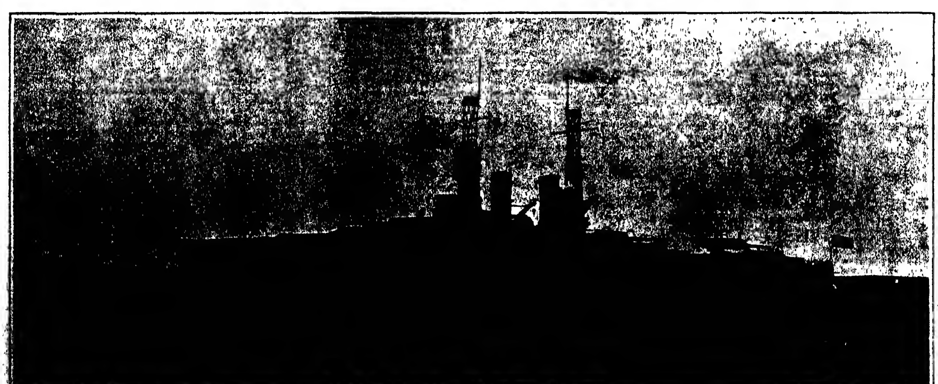
Nothing in its equipment has been overlooked which will contribute to good hygiene and safety, and the walls are now covered with white enamel, using diffused ceiling lights and dust aspirators. On the fifth floor are the apparatus for the multiple board, which occupy each side of the long hall and are designed for 10,000 city subscribers, also the interurban boards. A second exchange board of like capacity is to be installed on the fourth floor. The present exchange serves only the central district of the town, and there are a number of other exchanges in various parts of the city. It is expected that the new exchange will be in full operation during the early part of next year.

Gale's Comet

A TELEGRAM received at Harvard from Prof. Charles N. Wunder, director of the Leander McCormick Observatory, gives the following position of Gale's Comet as observed at the Leander McCormick Observatory:

September 30.52 G.M.T.
R.A. 15 hours 18 minutes.
Dec. —6 degrees 36 minutes.

The comet was plainly visible in a 6-inch finder, but was invisible to the naked eye. No nucleus nor tail could be seen with the 26-inch telescope.



This vessel of 26,000 tons and the "Wyoming" are the first ships of the navy to carry twelve 12-inch guns. Note the straight sheer and lofty freeboard
Driven by 4-screw Parsons turbines. Speed, 21.5 knots.

Battleship "Arkansas," the most powerful ship at the Naval Review.

Inventions New and Interesting

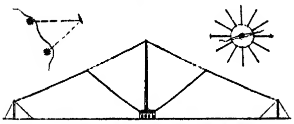
Simple Patent Law; Patent Office News; Notes on Trademarks

A Radio-telegraphic Compass

By Our Berlin Correspondent

NOT many years ago the Prussian Department of Public Works commenced some interesting experiments with a view to finding a method for determining the position of ships, dirigibles, aeroplanes, etc., in foggy weather. At two fixed points on the Müggel Lake, near Berlin, sets of antennæ were installed, each set consisting of thirty-two small poles equally spaced on the circumference of a circle six hundred and fifty feet in diameter. A wireless telegraph transmitter at the center of the circle was successively connected with pairs of diametrically opposed antennæ, and a different signal was given out from each. A wave-length was chosen equal to twice the diameter of the circle, so that the impulses of opposite phase would add themselves in the plane of the two antennæ, producing signals of maximum intensity in that direction, while at right angles to this plane the two impulses would strike the receiver simultaneously, compensating one for the other and producing a signal of minimum intensity. The positions of these stations were marked on the map, and the corresponding letters of each pair of antennæ, so that an airship could determine its position with respect to these two stations by noting which letters were received with a maximum intensity.

This scheme has recently been modified to facilitate the work of the telegraphist, and reduce the tax upon his memory. To the circle of antennæ as previously provided, another non-directed antenna is added. From the non-directed antenna short time signals are given out periodically, and these are followed by a succession of signals from the pairs of directed antennæ. These signals are identical with one another, and always begin at a given antenna, namely, the north-south antennæ, continuing therefrom in clockwise direction at a constant speed. A stop-watch is employed as a compass at the receiving station, the hand of the watch



Arrangement of the sending antennæ.

having the same angular velocity over the dial as that of the successive signals about the circle of antennæ. The receiver on hearing the time signal from the non-directed antennæ starts his stop-watch at the moment that the transmitter begins giving out directed signals. As soon as the signals are heard with a minimum of intensity, the receiver stops his watch and the hand then marks the direction corresponding to the minimum of intensity in the reception of signals. It takes but half a minute to complete a set of signals. Hence ten series of readings may be made in five minutes. At the transmitting station, the signals are given out by a self-acting switch. Consequently, the transmitting apparatus requires no superintendence. The aeronaut, knowing his direction, from two fixed points, can easily find his position at the intersection of two lines drawn in the corresponding directions on the map. It has been suggested that a series of such radio-telegraphic stations be located along the German frontier at distances of not more than thirty miles apart. Such stations would be of particular value on the north coast of Germany, to protect aeronauts against an involuntary flight over the sea. It is estimated that each station would require ½ kilowatt of energy which could be derived from existing power stations.

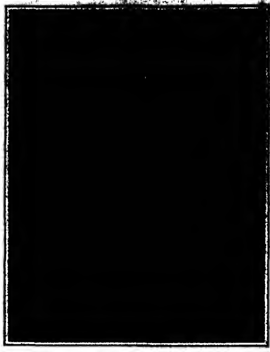
An Application Long Pending

A PATENT, the application for which was pending a long time, in fact almost equal to the record of delayed cases, is that issued on September 3d, 1912, No. 1,037,842, to Robert Creuzbauer of New York, N. Y., Helen M. Creuzbauer and Carrie Creuzbauer of Brooklyn, N. Y., and Grace C. Nichols of New York, N. Y., executors of said Robert Creuzbauer, deceased.

The application was filed in the United States Patent Office, July 7th, 1888, more than twenty-four years prior to the issue of the patent.

The inventor at the time of filing his application for a patent was a resident of Brooklyn and filed the application without having any attorney of record, and the application was prosecuted from time to time without an attorney's aid up to September 1st, 1890, when an attorney was appointed.

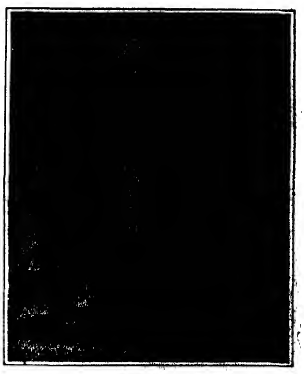
The record shows that many official letters were written in the progress of the case. The case was before the Commissioner on petition. The inventor died, and letters testamentary were filed in the application.



The radio-telegraphic compass.

When the application was filed in the Patent Office, Benton J. Hall was Commissioner of Patents and Prof. Fowler was examiner in charge of the class to which the application was assigned. Both of these officials have passed away, and Mr. Grenville Lewis, who was assistant examiner to Mr. Fowler at the time and subsequently became principal examiner in charge of the class, has also died, so that the application survived, in the Patent Office, the Commissioner, the examiner and the inventor.

The writer was told that during the progress of the case, the inventor grew old and extremely eccentric, and the family delayed the prosecution of the case until after his death, so that they might be able to handle the patent when issued, without obstruction or interference by him. This may or may not be true. It appears from the record that letters testamentary were granted upon the estate of Robert Creuzbauer on December 5th, 1911, and thereafter the application was prosecuted to its formal allowance on February 26th, 1912.



The revolving radio-telegraphic transmitter.

A Self-sealing All-rubber Tire for Automobiles

WITH the development of the automobile great strides have been made in eliminating the various sources of trouble in design and manufacture, and it is a rare thing to see an automobile disabled through imperfections in the motor or other parts; but one great source of annoyance—tire trouble—has so far resisted all attempts to overcome it without, in doing so, introducing objectionable features.

Many attempts have been made, especially in the past year, to produce a satisfactory tire by the use of various fillers, but this is at best a poor compromise between the solid and the pneumatic tire. The solid tire is, of course, impossible for pleasure riding. The pneumatic tire, aside from its liability to puncture, etc., is ideal for the pleasure car, and while various "filled" or "airless" tires do present certain advantages, they do not meet the requirements in point of comfort of riding and safety of the motor from injury.

With many technical minds concentrated upon this problem there is every reason to expect that it will sooner or later be solved. A new form of inner tube which has recently been placed on the market is well worthy of consideration as seemingly representing an important step in the right direction.

This tube contains no filler, no "dope" of any kind, but is a regular pneumatic tube inflated with air in the usual way, which, owing to some peculiar and very ingenious features in its construction, is in a large measure self-sealing, and will hold the air for a long

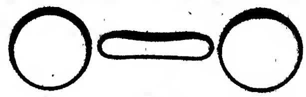


Fig. 1. Fig. 2. Fig. 3.

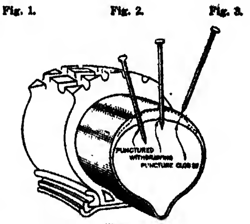


Fig. 4.

time, it is claimed, even after receiving a very severe puncture. The principle on which the construction of this tire is based can best be explained by reference to our illustrations. The inner tube is made rather heavy at the tread and has imbedded in it a strip of canvas seen in section in Fig. 1, which represents the appearance of the tube when first made. We now come to the important feature of the new tube. After a length of tubing has been made as usual and with the structure shown in Fig. 1, the tube is now turned inside out. An inspection of Fig. 1 will show that the canvas strip, forming as it does an arc of the inner circumference of the tube as first made, is necessarily shorter than the corresponding arc of the outer circumference of the tube. The consequence of this is that when the tube is turned inside out, the canvas strip is under tension, and being inelastic, and, therefore, unable to give way to this tension, it holds the deflated tire in a flat position as shown in Fig. 2. On inflation the tire is, of course, forced to assume a circular form, and the canvas strip being now situated on the external circumference and being, as already pointed out, inextensible, compresses the rubber underneath it, so that the tread portion of the inner tube is always under compression and, therefore, self-sealing. In point of fact a puncture made with a sharp nail or point seals itself automatically, so that it cannot be detected by the usual immersion in water.

The diagram of Fig. 4 is intended to show roughly the way in which the rubber behaves when a puncture is made. The nail on the left is shown in its entering position, when it drags the fiber of the rubber with it and raises a tuft of rubber on the inside of the tube. The nail on the right is being withdrawn and the fiber of the rubber is following in its motion. On the extreme right is seen a puncture sealed by the rubber

[illegible] is the invention of [illegible], who is known to the [illegible] of this paper as the inventor of [illegible] gun. If the new tire fulfills the expectations which are placed upon it, the inventor and manufacturers deserve our best wishes for success in perfecting this tube and placing it within the reach of the motorists, whose troubles from accidents to tires have been aggravating in the extreme.

Notes for Inventors

An Illusion Stage Device.—In patent No. 1,036,208 John B. Fitzpatrick of New York city presents an illusion apparatus including a substantially vertical track or frame within which a performer can walk. Means are provided for supporting the performer within the track or frame and to rotate within the frame as he traverses the circular track.

An Artificial Sausage Skin.—We have imitations of various sorts or substitutes, if you please, but Carl Hugo Hasselblad of Stockholm, Sweden, has patented, No. 1,036,989, an artificial sausage skin consisting of a sleeve of fabric impregnated with a gluey substance and in the production of which the sleeve of fabric is impregnated with a decoction of bacon rind and is also stiffened by the action of a salt of aluminium.

A Device to Identify Motor Vehicles in Case of Accident.—Oscar A. Weissenborn of Jersey City has secured patents, Nos. 1,036,942 and 1,037,092, relating to means for identifying motor or other vehicles in case of accident and by which he provides for the release in case of accident of a number of identification cards or checks. In one patent the cards are held in a receptacle, the cover of which is withdrawn in case of accident while in the other the identification checks are mounted on brackets secured to the front of the motor vehicle.

A Novel Cow Milker.—John Huggins of Indianapolis, Ind., has secured a patent, No. 1,034,454, for a cow milker, which simulates very closely the action of the hand in milking. The machine, however, fits against the underside of the animal's udder and is movable up and down and laterally and has fingers arranged in separate series for each teat, with the fingers so operated, that a starting movement of the fingers will be in succession from the upper one to the lower one, so that the milk will be gradually discharged from the teat.

A Fessenden Wireless Patent.—A patent, No. 1,035,384, has been issued to the National Electric Signaling Company as assignee of Reginald A. Fessenden of Brant Rock, Mass., for a wireless telegraph apparatus within an inclosure of energy-absorbing material with a protecting sheath composed of a non-absorbing conductor between the energy-absorbing material and the conductors of the apparatus. In its application to an iron ship, which forms the inclosure, the lead from the outside antennæ to the inclosed apparatus, is surrounded by a copper sheath where it passes through the walls of the inclosure.

Cushion for Baggage Trucks.—To protect trunks from damage when unloaded from or loaded on trucks in baggage rooms a cushion of simple construction has recently been put into use on a prominent railroad line. The cushion is in the form of a mat 22½ inches wide and 4 feet 4 inches long. It is made of four strips of hardwood, 4 inches wide and running the full length of the mat, across which are nailed twenty-four pieces of airbrake hose. The hose is held in place by means of half-inch clout nails, driven through the slats and clinched on the under side. The nails are attached to the hose by means of an [illegible] while the nails are being [illegible].

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

ELASTICALLY CONNECTED SURFACES FOR INSURING THE STABILITY OF AIRSHIPS, AEROPLANES AND SUBMARINE BOATS.—G. A. CROCCO and O. RICALDONI, Laboscetta, Rome, Italy. This invention diminishes the surface necessary for securing the stability of moving bodies such as dirigible airships, other aerial machines, self-propelling torpedoes, submarine boats, etc., by making use of planes with increased stabilizing action, provided either at the tail, or both at the head and the tail simultaneously, so that they cooperate, both during forward as well as backward movement.

AEROPLANE.—D. A. DAVISON, Murphy's Hotel, Grace St., Richmond, Va. This invention consists more particularly in a novel form of main sustaining planes or wings. An object is to provide means for maintaining equilibrium. A further object is to provide a novel form of plane which overcomes the disastrous effects of side movement due to the peculiar formation of the sustaining wings.

Of Interest to Farmers.

APPARATUS FOR SPROUTING GRAIN.—E. MCFARLIN and A. CLINE, Doniphan, Mo. An object here is to provide an apparatus by means of which the grain may be kept at the required temperature and can be supplied with moisture as desired. Further, to provide means for fertilizing seeds during the sprouting period, so as to obviate the necessity of mixing the fertilizer with the seed prior to planting.

GRAIN SHOCKER.—P. W. SHARP, R. F. D. No. 3, Osakis, Minn. This shocker is adapted for attachment to any grain binder. The bundled grain is delivered from the binder platform to a receiving disk, wherein the bundles are grouped and held around a conical support until enough bundles have been thus assembled, after which the operative mechanism is automatically set in motion and a shock conveyer automatically grasps the assembled bundles and sets them on the ground formed in a shock.

Of General Interest.

DRINKING FOUNTAIN.—T. E. LINDSAY, Jackson, Tenn. The object of the inventor is to provide a new and improved drinking fountain formed with improved means for dispensing the drinking fluid, and associated with improved means for providing a cooling element and a flushing device.

COAL DISTRIBUTOR.—E. L. VISE and C. DENHAM, P. O. Box 55, West Terre Haute, Ind. In this patent the invention relates to an apparatus whereby coal is discharged from a primary distributer upon another which is in the nature of a chute adapted to deliver different grades of coal to different receptacles, especially cars for transportation.

FISH NET REEL.—H. A. MONROE, 367 8th St., Astoria, Ore. This invention provides a reel for gathering fish nets, adapted to be manually or power-driven; provides a reel having gripping devices which are arranged to yield to a predetermined strain, to avoid breakage of the same; and provides an outrigger conveyer section for extension beyond the gunwale of the boat for which the reel is provided.

Hardware and Tools.

PRUNING KNIFE.—W. SCIONEAUX, care of L. J. Le Jeune, Donaldsonville, La. In this instance the invention relates to a new and improved form of pruning knife, and is particularly adapted to be used as a briar hook on the edge of a bank of a ditch, to cut and at the same time raise the grass from the bottom of the ditch.

ATTACHMENT FOR SQUARES.—L. M. HOOGS, Wilmington, Cal. In this case use is made of a stock having clamping devices for clamping the stock to the members of a square, a graduated straight arm held on the stock and provided with an angular foot adapted to rest on one edge of one of the members of the square to hold the arm at a right angle to the said members, and a graduated segmental arm mounted to swing on the stock and adapted to be fastened thereto.

Household Utilities.

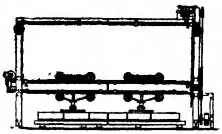
APPARATUS FOR FLUSHING WATER CLOSETS AND THE LIKE.—H. GOLDAU, Züllichau, Prussia, Germany. In the present invention the improvement has reference to an apparatus for use in flushing water closets, and the like, and is designed to enable two different quantities of water to be caused to flow into the closet pan, so that either the usual, or the smaller, flushing action is secured.

CLOSET ATTACHMENT.—HARRY R. KIRSSIG, 2037 Virginia Ave., Berkley, Cal. By means of the construction of this device the easiest and best position is secured for carrying out the physiological and anatomical purpose of the invention. No change need be made in the usual equipment of the bowl, and the seat may be used in the ordinary way if desired.

ADJUSTABLE BED.—D. R. ALLEN, care of Max Levy, attorney, Newport, R. I. An object of this invention is to provide a device which may be attached to an ordinary bed near the upper end thereof, which forms a shoulder and head-rest for the occupant, and which may be adjusted at various angular positions for supporting the body at various inclinations.

Machines and Mechanical Devices.

POLISHING MACHINE.—J. F. MARONI, Wheelock St., Montpelier, Vt. This machine is for use in treating or dressing stone, or other material. In operation and the cable running, the bridge may be brought to one side, while a bed of stones is prepared on the other, an overhead crane being used to bring the stones to the machine and leveling the same. The bridge is then moved over the bed and the scrolls brought into contact with the

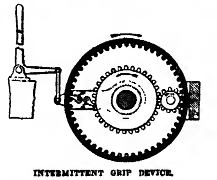


POLISHING MACHINE FOR GRANITE OR MARBLE.

work and started to operate. While the scrools are engaged on the bed, the crane is preparing another bed on the other side, and when one bed is completed the bridge is moved over to the other bed, and so on, one always being ready for the machine. Shifting of the bridge laterally while the trolleys are traveling longitudinally is desirable. A side elevation of the machine is shown in the accompanying engraving.

Prime Movers and Their Accessories.

INTERMITTENT GRIP DEVICE.—J. CALKINS and F. RICE, 502 Huron St., Port Huron, Mich. The invention relates to a device forming part of a cranking or starting mechanism for internal combustion engines, such as used on automobiles, motor boats, aeroplanes and other machines and devices. Use is made of a manually controlled lever, carrying spring-pressed pawls engaging concentric gear

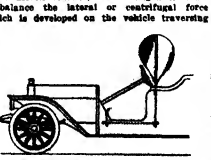


INTERMITTENT GRIP DEVICE.

wheels geared together by an intermediate gear wheel, these gear wheels being secured on a shaft, and a spring-pressed clutch mechanism connecting one of the said gear wheels with the shaft, so that when the lever is actuated the shaft is driven continually in one direction. The engraving shows a sectional elevation of the engine starting-mechanism connected with an engine shaft.

Pertaining to Vehicles.

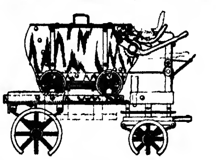
AIR DEFLECTOR.—H. C. DUNLAVY, 705 O St. Fresno, Cal. This inventor provides an air deflector, more especially designed for use on high speed or racing automobiles and other power-driven vehicles, and arranged to counterbalance the lateral or centrifugal force which is developed on the vehicle traversing



AIR DEFLECTOR APPLIED TO AN AUTOMOBILE.

a curved course, the air deflector serving to relieve the wheels or tires of undue strain, and prevent slipping of the tires on the roadway. For this purpose, use is made of a vane mounted on a vehicle shaft journaled on the vehicle and under the operator's control. The accompanying illustration shows a side elevation of the air deflector as applied to an automobile.

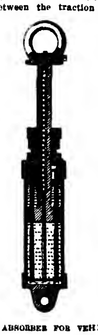
DUMPING VEHICLE.—J. JANUKAITIS, 304 26th St., Brooklyn, N. Y. The invention relates to a dumping vehicle particularly adapted for the transportation of asphalt, and shown herewith in a side elevation, parts of the truck being broken away to show the



DUMPING VEHICLE.

track and showing the mechanism in two parts. It provides a street truck which may be used as is usual with trucks of this character and which may be converted into an open bottom truck for the discharge of material carried by a cart mounted thereon. The vehicle has improved means for dumping the material from the cart, which means is disposed adjacent the driver's seat.

SHOCK ABSORBER.—F. M. RENNIE, 344 W. 18th St., New York, N. Y. This invention is intended more particularly as an improvement in pneumatic shock absorbers for automobiles and other vehicles, whereby the device is adapted to cushion sudden relative movements between the traction wheels and



SHOCK ABSORBER FOR VEHICLES.

the vehicle body. The movement between the relatively movable parts is restrained during the last part of each of the long strokes yet is substantially unrestrained during the first part of said strokes as well as during the shorter strokes. The invention also provides means for taking up the heavy jars independently of the means absorbing the relative slight pulsations. The engraving shows a vertical transverse sectional view of the invention.

CARRIAGE WINDOW.—A. M. MODAY, 487 Prospect Place, Brooklyn, N. Y. This invention comprises a pocket into which the window sash can be inserted, and from which withdrawn, and means for guiding the sash in the course of its movements into and out of the pocket. These means engage the edges of the sash at all times with sufficient tightness to eliminate objectionable jarring and rattling met with in many carriage windows now in use.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We are prepared to render opinions as to validity or infringement of patents, or with regard to conflicts arising in trade-mark and unfair competition matters.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & CO.,
Patent Attorneys,
361 Broadway,
New York, N. Y.

Branch Office:
625 F Street, N. W.,
Washington, D. C.

Duplicating Machines

(Concluded from page 300)

Events began to move more rapidly, with the result that other flat-bed duplicators appeared upon the market—other cylinder duplicators appeared, each in its turn claiming to be a further improvement and development over the former models.

Duplicating machines are now on the market with address plates, which can be inserted in the machine so that each letter duplicated is addressed at the same operation. The advantage of a machine of this character lies in the fact that the inked impression of the address and the reproduced letter are identical, as both are printed from the same ribbon.

Then followed the direct inking device, attached to a duplicating machine and the automatic feed, so that to-day a duplicating machine becomes an office printer, as the operator simply places in the machine an electrotype plate, together with a quantity of paper, turns on the current and the machine does its own feeding, printing and ejecting.

To go a step further, another firm brings out a machine that is a duplicating machine and addressing machine in one. It, too, is automatic, and after the form is set-up the operator takes the addressing machine list, places the addressing plates in the magazine, equips the outfit with a supply of paper, turns on the current, with the result that the name, address, and salutation are automatically changed upon each letter. In other words, the letter is ready for final mailing.

More recently, one of the duplicating devices has been equipped with a signature device so that when the letter is duplicated the signature is automatically placed upon the bottom of the letter, and the imitation is so excellent that it is accepted by many as a true signature.

While the office duplicating machine for duplicating letters in quantities was being developed to a high point of perfection the machine for producing shop orders and for splitting orders for departments was not being neglected. To accomplish this work rapidly a mechanical means was developed by taking the gelatine rolls, which had been used in the old-fashioned way for so many years, and mounting the rolls on a metal frame equipped with a carriage, thus making it possible to deliver and remove the copies from the gelatine rolls through mechanical means. The result of this improved device has been that thousands of dollars have been saved by a number of large electrical firms, packing companies, and steel companies, who have been enabled to effect a saving in one month which paid for the entire equipment.

Very recently there has been produced a remarkable photographic device which delivers within a few minutes a duplicate of a design or drawing—photographically reproduces a piece of machinery or a sample cartoon, or supplies a photograph of a new lace curtain design. In fact, this new photographic device can be used in a thousand different ways in the conduct of business, and for this device there is already a very large field prepared to adopt the outfit as rapidly as it is known that such a machine is available.

Signing Ten Times at Once.

Another wonderful duplicating device is the signature machine, which enables the user to sign his name ten or twenty times in one operation.

Through the use of a master pen all pens attached to the device are controlled and bonds, checks, and certificates are signed with great rapidity.

With all the wonderful duplicating devices and systems of all kinds and characters, the largest duplicating field of all remains untouched. A fortune awaits the inventor who will give his thought and attention to the simplest field which is the biggest field of all. There is to-day a world-wide demand for a simple device, not too cumbersome or expensive to install and not too expensive to maintain, which will enable each business house to

secure from one to six copies of its statistical reports, sales records, departments charts, balance sheets, etc.

There is a demand for a device or system which will secure a true reproduction of certain correspondence, some of which is accompanied by intricate orders or sketches, the original of which must remain in the office. At the present time it is necessary to make a duplicate by hand so that quotations upon certain work can be secured through other departments. If a simple and inexpensive device can be secured thousands of dollars can be saved, as with one or two copies of a letter made at a moment's notice, invaluable time could be saved.

If, at the present time, an important letter is received which two officials must see immediately, one must now wait upon the other, while in some cases there is nothing to do but make copies of the letter or papers so that two or three officials can each have their working copy.

Street railways make up large reports weekly. These reports have been added to day by day with a pen, and when completed from four to six copies are needed, but at the present time there is no method except to take carbon copies of these sheets, which are nothing but a mass of figures in columns and ruled boxes.

Inventors have apparently been looking at the duplicating proposition from the outside of the office, and have given little attention to the largest field of all, nor have they appreciated the opportunity which is waiting for the man who will give the business world the duplicating device which they need most of all.

How One County Built a Good Road

(Concluded from page 308)

hint that an entirely new and shorter road between important points might be opened, and that it would very likely run through his property. Well, it was the disagreeable task of the commission to undeceive nine tenths of the farmers in the district. It was to be expected that some of the hearings before the commission would be a trifle strenuous, and the members were not disappointed.

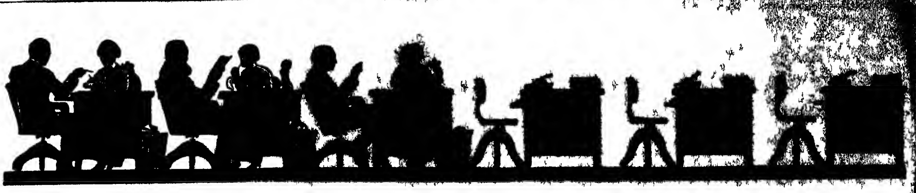
However, at length it was decided to pave with brick the road leading from Chester, the largest town in the district, toward Hookstown, as far as the Pennsylvania State line, a distance of three and one half miles. The road leading from Chester to Fairview, a town in another district in the same county, is to be paved for two and one half miles. The remaining money is to be expended upon paving one road leading from Newell and one from Arroyo, the only other towns in the district.

Surveyors and engineers were then employed and grades established, for the most part along the lines of the old roads, though occasionally to secure a road not quite so precipitous slight deviations were made from the old highway. In one place where a road followed the bed of a small creek for a short distance in a narrow valley, it was necessary to cut an entirely new road in the hillside.

It was decided that the foundation should be of broken stone seven inches thick, covered with three inches of gravel and two inches of sand. On this foundation bricks four inches thick are to be laid. The pavement itself will be nine feet wide with concrete curbs on each side. A dirt driveway will parallel the pavement. Wherever practicable it will be of the same width as the pavement.

While the cost of grading is heavy, stone for the foundation costs practically nothing, for in most places it can be dug from ledges along the road. Gravel and sand can be procured at small cost from the Ohio River. The paving brick are manufactured in the country scarcely ten miles from where the roads are being built and can be shipped to the district at small cost for freight. The contract for grading, paving and curbing was let by competitive bidding after the specifications had been well advertised in the local papers. A man, from another State, from Ohio, secured the contract.

Notwithstanding the bitter opposition



No more idle waiting desks

HOW many half-time desks in your office—desks and machines standing idle while the stenographers are somewhere else simply taking notes *or getting ready* to write your letters?

Did you ever figure up the "half-time" girls you pay full wages—the half-time typewriters you pay full price for—the half-time desk room you pay full rent on? Can your business *stand* this half-time production at full expense, when there is a way to make stenographer, desk and machine *produce* every minute of the day?

But even more important than your typist's time—large as the saving totals day by day—is *your* time, the time of the high-priced man

When you dictate *now*, you must wait for your stenographer to come with book and pencil You must adjust the speed of your speech to her ability to take it down Often you must wait for her to catch up. Your whole day's work is measured, not by *your* capacity, but by the capacity of your stenographer.

Dictate to the Dictaphone

and put an end to *waiting* to the long hours of *getting ready* Your typist begins work at *her* desk practically as soon as you do at *yours* Your first letter dictated she starts transcribing it and from then on *all* day no matter what you are doing she is busy She turns out twice as many letters because she is at her machine twice as long She does them faster and better because she does not need to strain her eyes looking back and forth from her book She does not stop to decipher illegible notes She simply *copies* fast and easily what you have talked into the Dictaphone—what the Dictaphone talks to her

You can dictate any time—get the idea out of your system while it is hot with enthusiasm—and you don't have to stumble along at eighty words a minute There is no speed limit to the Dictaphone You can talk fast, naturally, energetically, two hundred words a minute if you wish—just as you would if the man you wrote to sat beside your desk. Result not lifeless formalities but red-blooded letters that get results

Don t worry about the cost of the Dictaphone. You can figure yourself that when it cuts your correspondence expenses in half it is going to pay for itself in a very few months.

Demonstration in your own office and on your own work Reach for your telephone and call up "THE DICTAPHONE." If you don't find that name in the telephone book, write our nearest distributing branch

THE DICTAPHONE (Columbia Phonograph Company, General, Sole Distributors), 138 Tribune Building, New York

Atlanta Baltimore Birmingham Boston Buffalo, Chicago Cincinnati, Cleveland Dallas, Denver Detroit Hartford, Indianapolis, Kansas City Los Angeles Louisville, Memphis, Minneapolis, Montreal, New Haven, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Me. Portland, Ore. Rochester San Francisco Scranton Seattle, Spokane, Springfield, St. Louis, St. Paul Terre Haute Toledo Washington, Wilmington. Canadian Headquarters, McKinnon Building, Toronto.

Exclusive selling rights granted where we are not actively represented

Trade Mark

Dictate to the

DICTAPHONE

to the bond issue for paving, there seems now to be only commendation for the promoters of the improvement. Following the special election of November, 1911, when the road bonds were authorized, a sentiment of pride in the improvement rapidly swept over the district. It is almost impossible now to find a man who will acknowledge that he voted against the good roads project. During the campaign preceding the last regular election to fill county and district offices, nearly every candidate claimed loudly the honor of having been the originator of the plan to pave the roads.

The heavy rains of the last month have retarded greatly the work on the improvement of the roads by washing out the sand and gravel spread in place ready for the laying of bricks. The loss, which amounts to several thousands of dollars, will have to be borne by the contractor. Had the weather been dry during the last month several miles of pavement would have been in place by this time.

The International Congress on Hygiene

A Review of a Remarkable Convention

THE Fifteenth International Congress on Hygiene and Demography, which closed its sessions at Washington, D. C., on the 28th of last month, was the first to assemble on United States soil, and is generally admitted to have been, in some respects at least, the most important held so far in the history of the institution. In no other meeting of the congress have there been communications so promising for the future of hygiene, while several of the discoveries brought to the attention of the delegates are in themselves notable advances in biological and medical science. Among these is the discovery by Dr. Frederick Novy, of the University of Michigan, of a micro-organism which may prove of value in checking the bubonic plague. Next, if not equal, in importance are the discoveries that typhus germs are carried upon the bodies of certain parasitic insects, and that the germs of measles may be disseminated not only by desquamation, as has been believed, but also by sneezing.

The gathering, presided over by Dr. Henry P. Walcott, of Massachusetts, included representatives from every civilized nation, numbering about 3,000, probably the most noteworthy scientific assembly ever seen in the national capital.

Insects and Books as Disease Carriers.

It was on this first day of the congress that Dr. Frederick G. Novy announced his discovery of a micro-organism which he regards as possibly of high value in dealing with the bubonic plague. It is peculiarly fatal to rats, the generally acknowledged carriers of the bubonic plague, and plainly suggests a means of exterminating these rodents. Drs. John F. Anderson and Joseph Goldberger, of the United States Public Health Service, announced, among other discoveries made in the course of experiments on monkeys, that they had traced typhus fever to an insect—the louse—as a carrier, and that their investigations along this line had disclosed nearly 300 cases of the disease in New York city, as well as many others in Chicago, Philadelphia, Baltimore, and Washington, although it was thought that typhus had not visited America for some years.

In the section of hygienic microbiology, William R. Reinick, of Philadelphia, speaking of books as disease carriers, said that analysis of dust taken from books lying untouched for forty years in Florida, showed that it contained diphtheria, typhus, [illegible], and tuberculosis bacilli.

Water and Food Supply.

An interesting discussion was the sequel of a paper read on the second day by Prof. Edwin O. Jordan, of the University of Chicago, on the Purification of Drinking Water. The emphasis laid by Prof. Jordan upon [illegible] tests for the detection of [illegible] germs elicited a protest from [illegible], of the

University of Jena, who maintained the superior effectiveness of sanitary surveys. To this criticism Prof. Jordan replied, admitting the importance of the sanitary survey so far as it went, but denying its sufficiency apart from bacteriological examination. Dr. Gaertner also took issue with Dr. A. C. Houston, director of the Metropolitan Water Board of London, on the Purification of Water by Storage, and questioned the claims of certain French scientists for the purifying power of the ultra-violet rays.

In his address on "The Nutriment of the People," Prof. Max Rubner, speaking from his experience of German dietetic habits, said that the increased cost of living and social ambition were both telling upon the population of his own country. He said:

"One of the greatest, if not the greatest, of problems now confronting mankind is that of providing the race with proper nourishment. It is of such importance, in fact, that every large city should have a department in its government clothed with plenary powers of caring for this branch of the people's welfare. Changed conditions in the last half century have brought the question of feeding the human race to a critical point. The growth of the cities and of the industrial workers as a class has complicated the problem to a point where it is becoming necessary for the city governments to maintain a jealous watch that all of their citizens receive the proper nourishment."

After urging that ill-nourished children should be fed by the public school authorities, Dr. Rubner continued:

"There has been a distinct step backward in the organism of the workingman. This is due to two causes: First, insufficient nourishment, and, second, the fact that the new era of machinery has specialized and confined his physical exertions so that he gets little or no natural exercise."

Hygiene of the Very Young.

A paper by Augustin Ray, a distinguished French architect, read by Mr. Adolphe Smith, of the London *Lancet*, before the section of school hygiene, insisted upon the importance of ultra-violet rays to human health. We cannot demand too forcibly, Mr. Ray thinks, that ultra-violet light shall be largely admitted into dwellings as a factor of microbian purification. In killing the microbes, we incidentally preserve the eyesight of the children, and for this purpose the windows of school buildings should be specially constructed: "No classroom is satisfactory that is not well disinfected by the direct rays of the sun." Private speculation in land, therefore, should, in the opinion of Mr. Ray, be checked.

Dr. C. Ward Crampton, director of Physical Training in the New York Public Schools, advanced the theory that school children should be classified rather by their physiological development than by age, in order that appropriate treatment may be applied to the mature and the immature. Dr. Caroline Hedger, of Chicago, presented a strong plea in her address on "The School Children of the Stock Yards District."

Industrial Dangers.

Henry Japp, of the American Society of Civil Engineers, plausibly advocated the adoption of the medical air-lock in all caisson workings, asserting that when it was first introduced it brought down the "death rate from caisson disease from 25 per cent to 1 per cent, and in the latest of the large engineering enterprises the death rate has been reduced still further, to nineteen one-hundredths of 1 per cent."

Mr. T. Kennard Thomson, treating the same subject, maintained that many cases of the disease are due to foul air rather than to compressed air, and he cited in support of this view instances which occurred in the construction of the Lenox Avenue Bridge, New York city.

An apparent difference of views developed upon the paper on "Injuries Caused by Electricity," which was presented by Sir Thomas Oliver. This paper included the following directions for first aid to persons suffering from electric shock:—

"The first thing a rescuer has to do is to sever the contact by cutting the wire, care being taken to protect the hands by dry clothes. The greatest care must be exercised in

moving the body from the live metal, and especially if the workman's clothes are damp. India rubber gloves are the best protective. When the body has been removed from contact it should be placed upon its back, medical assistance sent for, and artificial respiration should at once be started and continued for a long time."

Dr. J. D. McGowan, surgeon of the Commonwealth Edison Company of Chicago, was inclined to a more optimistic view of the accidental dangers of the electric current than had been taken by Sir Thomas at the opening of his paper. Dr. McGowan declared that, among hundreds of cases of shock within his observation, where immediate death had not taken place, the patient never suffered except from the local effect of the burns. The impression that such shocks cause paralysis and brain lesions, where they do not instantly kill, is, he asserted, erroneous.

Human Vehicles of Disease.

Wednesday, the third day of the congress, brought with it discussions of unusually wide interest. Among them were those which followed the papers on infectious diseases, read by Drs. J. C. Ledingham, of the Lister Institute, London, and William Lorenze Moss, of the Johns Hopkins University. The case of "Typhoid Mary," it appeared, had attracted much professional attention on the other side of the Atlantic; but it was not unique. Dr. Charles Boldman, of the New York city Department of Health, said:

"Typhoid bacillus carriers have a very large share in producing typhoid infections in New York city. In particular, great importance attaches to the chronic typhoid bacillus carrier employed in dairying. One such carrier studied by me caused over 800 cases of typhoid fever in New York. It is now agreed that no known typhoid carriers should be allowed to engage in dairying. The great difficulty at the present time is the recognition of these carriers, and this, like many other public health problems, is largely a question of expense."

Dr. Fornet, of Berlin, argued that the campaign against typhoid begun in Germany eight years ago has shown that the disease sticks to the place where it has once occurred. He added:

"The fact that I could trace thirty-one families where two or even more members were typhoid-hosts makes it likely that a second infection with typhoid bacilli often makes people become bacilli carriers, a theory I could verify by experiments on beasts. Cleanliness alone can do much in preventing this undesirable state of the body."

Dr. A. C. Abbott, of Philadelphia, said that in his city the authorities, having examined every child in a certain school situated in a district of 15,000 inhabitants, found thirty bacillus carriers among the pupils, sent them home, and in this way put an end to an epidemic of diphtheria which had already made some headway.

The Brass Founder's Perils.

Statistics gathered by the Illinois Commission on Occupational Diseases show that in 1910 only 17 out of 1,761 brass founders in Chicago were over 50 years of age, while less than 15 per cent were over 40. Investigations made in England a few years ago developed the fact that only 10 brass founders out of 1,200 were over 60 years of age. Dr. Emery R. Hayhurst, after speaking of the more general sanitary conditions of this occupation, discussed more particularly the disease known as "brass founders' ague," which a German investigator, Lehmann, has traced to the inhalation of zinc fumes. Dr. Hayhurst, in maintaining the thesis that these special occupational maladies are preventable, said that the workers "must not breathe an atmosphere laden with zinc or other metallic fumes. Brass chills practically never occur in spacious, well-ventilated foundries or smelters. Higher ceilings, more partitions, better eating and sanitary quarters, better natural ventilation, and artificial ventilation for the pouring hours, especially in winter time, are all that are required. There are no antidotes for brass founders' ague. The workmen's remedy, whisky, is worse than useless; all is prevention."

Two topics of sensational interest to the general public treated on this day were the victorious war carried on by the United States authorities in Porto Rico

against the hookworm, and the appalling statistics of infant mortality. The former was the subject of an address by Dr. Bailey K. Ashford, U. S. A.; in speaking of the latter, Edward Bunnell Phelps, editor of the *American Underwriter*, told the section on demography that the world's infant mortality probably reaches the enormous figure of 40,000 babies' deaths each day, year in and year out, while in the United States the number probably reaches 1,000 a day. Mr. Phelps held that the world's infant mortality can very well be reduced 50 per cent.

Mental Hygiene and Criminology.

On the fourth day of the congress, Dr. Woods Hutchinson, of New York, addressing the section of mental hygiene, claimed to have information that the principals in the famous Los Angeles bomb outrage were victims of hereditary taint. Continuing along this line of argument, the speaker recommended that all children ascertained to be mentally defective should be segregated from the schools. The discussion was further developed by Dr. L. F. Barker, of Johns Hopkins University, president of the section, and also president of the National Committee on Mental Hygiene. Dr. Barker explained the meaning of the National Committee's campaign as "a systematic attempt to secure human brains so naturally endowed and matured that people will think, feel, and act better than they do now."

In his paper on "The Problem of Drunkenness," Dr. Irwin H. Neff, of Massachusetts, dwelt upon the futility of punitive measures. He also insisted that control by State or municipal authorities is necessary to efficiency in the treatment of confirmed drunkenness, and laid down as fundamental in such treatment the following two principles:

"1. A comparatively small percentage of users of alcohol are confirmed drunkards or inebriates.

"2. The appropriate care of the alcoholic implies both curative treatment and custodial care; the curative treatment being directed to the case which is likely to be benefited. The custodial, for economic reasons, should be directed to the recidivist constantly appearing in the courts. Such a differentiation must eventually be made and appropriate segregation of these two types established."

Hygiene of the American Farm.

On the fourth day also the State Health Commissioner of Indiana, Dr. J. H. Hurty, exhibited the sanitary conditions of American farms in a light very surprising to those who have held the conventional opinions of rural well-being. Said Dr. Hurty:

"Most farm houses are unsanitary. In them the farmers and their families experience frequent illnesses and early death. The natural duration of life is realized by only one half on the farm. It is astonishing to note the frequency of the intimate relations of the farm well and the cesspool. The farmer seems determined to locate his cesspool so that its contents will feed the well."

Farm-house cooking, he maintained, is done in dirty kitchens, with the assistance of flies and cats, while the ventilation, in winter at least, is all that it should not be.

Nathan Straus on Milk.

At the Friday sessions Mr. Nathan Straus, the founder of the New York milk depots, spoke on the subject with which his name is so honorably associated:

"It is the duty of the public authorities to see that the milk supplies are pure and wholesome, but it was because the municipal authorities were not alive to their opportunity and their duty that there was place and work for voluntary organizations, and it is because individuals and associations took up this work of protecting the babies that there has at length come a great awakening, and we now have boards of health in hundreds of cities more or less effectively working for the betterment of the milk supplies."

During the summer of 1912, Mr. Straus said, there was but one death among the 22,000 babies supplied from the Straus laboratories; and this one fatality was due to pneumonia.

Anaphylaxis to Infectious Diseases.

A brilliant prospect of victory over typhoid and tuberculosis was revealed in the paper read by Dr. Victor C. Vaughan, of the University of Michigan. Of ty-

phoid Dr. Vaughan pointed out that the period of incubation lasted about ten days. Then comes the period when "the onset of the disease manifests itself. This marks the time when the body cells have been sensitized, beginning to elaborate in active form a secretion which splits up and destroys the typhoid bacilli. This continues during the course of the disease. In splitting up the invading organism the protein poison is set free, and this is accountable for the symptoms and lesions of the disease. If the poison is set free too rapidly the temperature falls and death results. This is practically what occurs in every infectious disease, whether it be of bacterial or protozoal origin." Dr. Vaughan went on to adumbrate a process by which the cells of the body can be trained to grapple successfully with this poison. If his conclusions are verified in practice, a means will have been found to resist typhoid and other infectious diseases, just as effectually as we now resist smallpox. "At the cost of untold sickness and numberless deaths," he said, "the white man is becoming immune to tuberculosis, but this increasing resistance may be strengthened by the general use of vaccine. A perfectly harmless and efficient vaccine can be obtained. Not only will this prevent tuberculosis and other diseases, but it will cure them."

Final Sessions.

The final day of the fifteenth congress was marked by the passage of resolutions, among which was one approving a proposal for an international committee to promote a uniform classification of colon bacilli. The most important recommendations were: An international agreement to secure uniformity in the reporting of occupational diseases; greater uniformity in medical department reports of the navies of the world as to causes of disability or death; an international agreement on the manner of collecting reports on marriages, births, deaths, and divorces, and that such reports, when made, shall conform to a uniform standard, and be periodically published; a commission to secure uniformity in criminological statistics; lastly, that the permanent International Committee be instructed to establish a permanent bureau for future congresses, such bureau to be established in the near future, with headquarters at The Hague.

No definite arrangement was made as to the place of meeting of the next congress (1915). A strong tendency was manifested to accept the only invitation thus far extended, that of the Brazilian government; but the general feeling eventually proved to be opposed to two successive gatherings in the New World, and Russia would have been decided on as the next rendezvous, but that the invitation of the Czar's government had not reached Washington when the congress adjourned.

Daniel Webster on Patent Property

OUR attention has been called by George D. Seymour, Esq., of the New Haven Bar, to the able argument of Daniel Webster in the suit brought by Charles Goodyear vs. Horace H. Day in the U. S. Circuit Court, District of New Jersey, for the infringement of Goodyear's patents of 1839 and 1849 for Improvements in the Vulcanization of Rubber.

Mr. Webster appeared as counsel on behalf of the complainant and the extract from his argument which is here reproduced shows that this learned statesman as far back as 1852 had the right conception of the protection to patent property rights which the framers of the Constitution intended to secure to inventors. As pointed out by Mr. Webster, it was not the intention of the framers of the Constitution to grant monopolies, that is, to restrict and confine to a few, rights which had theretofore belonged to all, nor to actually grant property rights, but the intention was to secure for a limited time the exclusive right of property in something that had never existed until the inventor produced it, and which but for his efforts would perhaps never have been known.

Mr. Webster, it seems to us, has clearly

and lucidly pointed out why patent property should be afforded equal protection with other kinds of property and the equities for such protection. A man who clears a part of the wilderness and produces a fertile farm in time acquires title thereto which the courts will protect forever, and while he has by such act advanced the progress of civilization, he certainly has done no more than the inventor to advance the progress of civilization. Surely the inventor is also entitled to that protection which the framers of the Constitution intended he should have for the limited period which Congress has fixed as the term of a patent. Mr. Webster said:

"It is provided in the Constitution of the United States, that Congress shall have power to promote the progress of science and the useful arts by securing for a limited time, to authors and inventors, the exclusive right to their respective writings and discoveries. The law acknowledges the existence of the right of an inventor to his invention as property, and the Constitution is remarkably exact in the language in which it speaks of this important subject. The Constitution does not attempt to *give* an inventor a right to his invention, or to an author a right to his literary productions. No such thing. But the Constitution *recognizes* an original, pre-existing, inherent right of property in the invention, and authorizes Congress to secure to inventors the enjoyment of that right. But the right existed before the Constitution and above the Constitution, and is, as a natural right, more clear than that which a man can assert in almost any other kind of property. What a man earns by thought, study and care, is as much his own as what he obtains by his hands. It is said that, by the natural law, the son has no right to inherit the estate of his father—or to take it by devise. But the natural law gives man a right to his own acquisitions, as in the case of securing a quadruped, a bird, or a fish by his skill, industry or perseverance. Invention, as a right of property, stands higher than inheritance or devise, because *it is personal earning*. It is more like acquisitions by the original right of nature. In all these there is an effort of mind as well as muscular strength.

"Upon acknowledged principles, rights acquired by invention stand on plainer principles of natural law than most other rights of property. Blackstone, and every other able writer on public law, thus regards this natural right and asserts man's title to his own invention or earnings.

"The right of an inventor to his invention is no monopoly. It is no monopoly in any other sense than as a man's own house is a monopoly. A monopoly, as it was understood in the ancient law, was a grant of the right to buy, sell, or carry on some particular trade, conferred on one of the king's subjects to the exclusion of all the rest. Such a monopoly is unjust. But a man's right to his own invention is a very different matter. It is no more a monopoly for him to possess that, than to possess his own homestead.

"But there is one remarkable difference in the two cases, which is this, that property in a man's own invention presents the only case where he is made to pay for the exclusive enjoyment of his own. For by law the permission so to enjoy the invention for a certain number of years is granted, on the condition that, at the expiration of the patent, the invention shall belong to the public. Not so with houses; not so with lands; nothing is paid for them, except the usual amount of taxation; but for the right to use his own, which the natural law gives him, the inventor, as we have just seen, pays an enormous price. Yet there is a clamor out of doors, calculated to debauch the public mind.

"But a better feeling begins to prevail. A more intelligent estimate of this species of property begins to spring up. Yet I am sorry to say, that there have been men, there still are some men in the community, who would not do an immoral action, who would not for their lives 'pick a flaw' in their neighbor's title-deed, and who yet make no scruple of endeavoring by every means in their power to 'pick a flaw' in his patent. That feeling is unjust, illegal, and unsocial."

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12686) O. W. Le C. asks: Being interested in taking up mechanical engineering as a study course in college this fall, I wish to ask you what is generally accepted as the field of mechanical engineering, also the same as regards hydro-electric engineering. A. Mechanical engineering includes the design, building and operating of machinery whether driven by water, steam or other motive power. It includes the study of engines and fuels of all sorts, the strength and properties of materials used in construction, and the designing of machines. A hydro-electric engineer is an electrical engineer engaged in the development of water-power for the generation electricity. An electrical engineer is a mechanical engineer who is trained also in electrical engineering.

(12687) H. K. M. asks: 1. A writer in your paper stated that cyclones always turned clockwise in the northern hemisphere and the reverse in the southern hemisphere. Is that true? And if so, why is it so? A. A cyclone rotates counter-clockwise in the northern hemisphere and clockwise in the southern hemisphere. If the reverse statement appeared, as you say it did, in our columns at any time, we were lacking in vigilance in reading the proof. The reason is that the rotation of the earth upon its axis is more rapid toward the equator and less rapid toward the poles. In a cyclone the wind is blowing with the general currents of the atmosphere, north and south. For an instance take the air, which is moving from north to south in the northern hemisphere. As it moves to the south it comes to a region which is moving by the earth's rotation more rapidly toward the east than the place from which it has come and whose velocity is still retained. The earth's surface goes more rapidly to the east than this air does. It lags or blows toward the west. The reverse takes place with wind blowing from the south to the north in the northern hemisphere. In this way a whirling motion of the air counter-clockwise is set up and is maintained in all whirling bodies of air. The same reasoning will show how the storms in the southern hemisphere rotate clockwise. 2. In a recent issue of your paper there was an article describing the Sperry gyroscopic compass. The writer stated that the force that caused the compass to seek the poles was the revolution of the earth on its axis. How does the revolution of the earth cause the gyroscope to act as it does? A. The explanation of a gyroscope as a compass is based upon somewhat similar reasoning, although not so simple. It is a precessional effect. We recently published an article upon this subject with 13 illustrations in SUPPLEMENT 1864, price 10 cents. We would refer you to this article, since the matter cannot be treated satisfactorily in a letter.

(12688) E. H. asks: Will you kindly tell me where I can procure detailed information concerning ultra-violet rays? How they are produced, and exactly what this light is? A. Ultra-violet rays are always present in the light of the sun, the arc light, the Welsbach mantle lights, and in lesser degree in most white light from other sources. They are the rays of shorter wave length than those which the human retina can receive. They are rendered visible to the human eye by absorbing the longer waves from the light and allowing the ultra-violet waves to strike upon some substance which they can render luminous; that is, some substance in which they can produce longer waves which are able to affect the human retina. These waves possess all the qualities of ordinary light. They differ physically only in wave length from the waves which can affect the retina. The ultra-violet rays affect the photographic plate and produce the action which is called "taking a photograph." Many substances can be used to detect ultra-violet waves. Into a dark room introduce a beam of sunlight or electric light through an opening in which a screen of deep violet glass has been placed. Such a screen had better be bought from dealers in physical apparatus. The ultra-violet rays will pass readily through this screen and will traverse the room in the same path as the white light. Now hold in the path of the ultra-violet light a tumbler of kerosene oil; it will glow with a deep blue light. Many substances may be used with beautiful effects. Vaseline shines with deep yellowish green, a solution of quinine with deep blue. Many materials can be obtained from the dealers in apparatus for these beautiful experiments. The effects are often quite surprising. Write or draw upon white paper with the solution of quinine. When the paper is dry the marks will be almost invisible. In the ultra-violet light they stand out with startling distinctness. We can send you [illegible] AMERICAN SUPPLEMENTS at 10 cents each, containing articles upon [illegible]. Any good text-book of physics will describe the theory. [illegible] Century [illegible] price $2.50. [illegible]

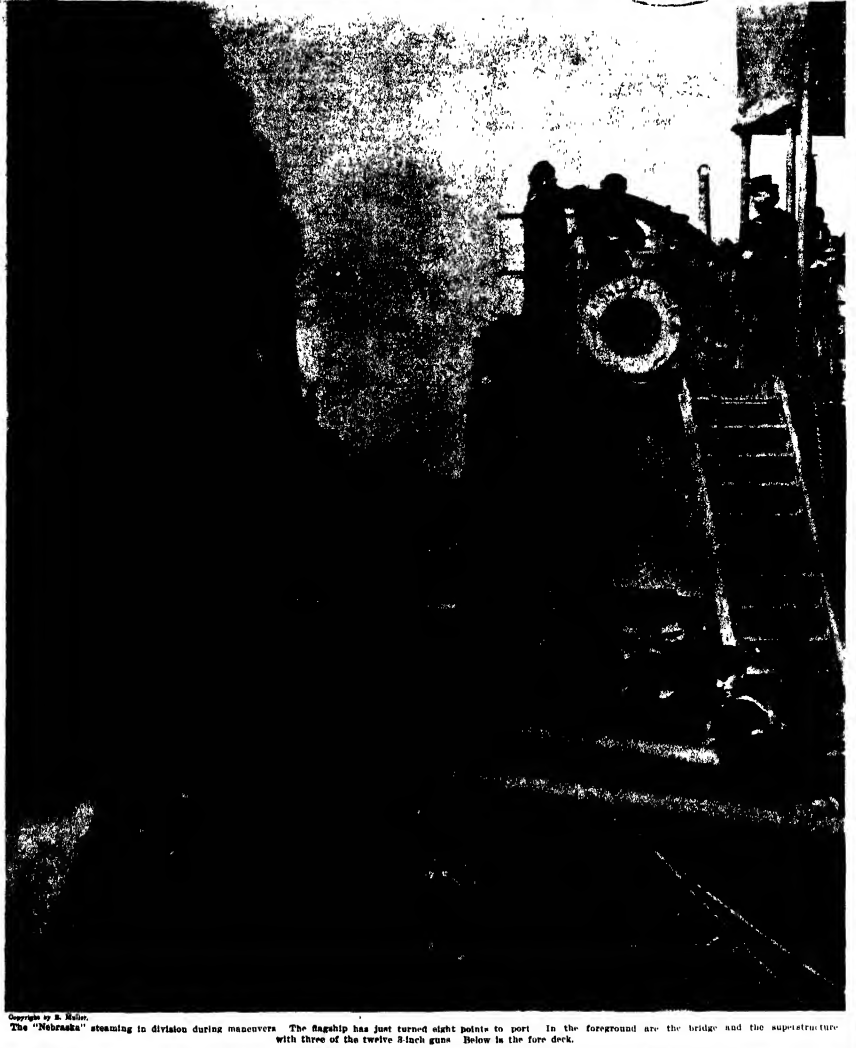
SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, OCTOBER 19, 1912

10 CENTS A COPY
$3.00 A YEAR



The "Nebraska" steaming in division during maneuvers The flagship has just turned eight points to port In the foreground are the bridge and the superstructure with three of the twelve 8-inch guns Below is the fore deck.

OUR FIRST LINE OF DEFENSE—A BATTLESHIP DIVISION IN MANEUVERS.—[See page 328.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, OCTOBER 19, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions, Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid,	3.75

The Scientific American Publications

Scientific American (established 1845)	per year,	$3.00
Scientific American Supplement (established 1876)	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Patent "Evils"

THREE so-called "evils" have been made the target of those who are responsible for the attempts to restrict the enjoyment of those exclusive rights which the inventor of a useful article or machine now enjoys under the Constitution.

First of all there is the "evil" of fixing the price at which a patented article is to be resold to the public. Patent-law reformers apparently fail to realize that no one is compelled to buy a patented article. If you object to paying $5 for a safety razor, you are at perfect liberty to use the old-fashioned naked blade. You are not deprived of anything that you enjoyed before. Surely there is here a fundamental difference between the monopoly which controls a necessity of life and fixes the price at which it may be sold, and surely the framers of the Constitution were right when they endeavored to encourage inventions by granting for a limited period a monopoly which often meant increased riches for the country.

The same argument applies to the "evils" supposed to arise when the vendor of a patented article prohibits its use, except in connection with other unpatented articles purchased from him. The history of one invention of which we know sheds much light on the practice. That invention is a duplicating machine which is now to be found in almost every well-equipped business office. The first attempts to introduce it were discouraging. It was offered to bank presidents and merchants at a price which represented but a small increase over its cost of manufacture—in other words a reasonable profit. Despite the merits of the machine, office managers would have none of it. Then it was that the patentee hit upon the idea of selling his machine at a little less than cost, with the understanding that he was to supply the stationery, the inks, and the supplies necessary to make duplicates by the machine. The effect was magical. Every one wanted to use the machine at the new low price. No one seemed to care that the manufacturer was deriving a far greater revenue from the profit on supplies, however reasonable that profit was, than he would possibly have earned had he succeeded in selling his machine at the original price and left to the purchaser the privilege of buying supplies wherever he could. Here we have an instance in which business strategy of a high order was required in order to introduce an invention which measurably increased the amount of business that could be handled with a small office force.

The third "evil" of which we hear much, is that of suppressing patents or prohibiting their use in order to prevent competition with other patented or unpatented articles sold by the owners of the patents. Not a single instance has come to our notice of wilful suppression. The telephone company, the manufacturers of type-setting and type-casting machinery, makers of typewriters and machine tools have taken out hundreds of patents which are not "worked." But in every one of these cases it will be found that the inventions have been developed by the companies themselves. Often as many as ten or even fifteen patents are taken out on as many machines for accomplishing but one result. Of these patents perhaps only one will be "worked," for the simple reason that the machine which it covers is the simplest and most efficient. Despite the fact that the unused patents represent an investment of perhaps $150,000 (not an unusual figure) in discarded inventions Mr. Oldfield would compel the owners of the patents to grant to any one the right to use them—in other words, grant a license which would create a rival who has himself contributed absolutely nothing to the art. Again, it seems to be overlooked that at the end of seventeen years, a patented invention becomes public property: anyone has the right to use or sell it. Even assuming that inventors or their assignees did suppress patents, what injury has the public sustained? It has been deprived of nothing; it has the right to use the invention after the legal monopoly has expired.

After all, Mr. Frederick P. Fish, one of our most eminent patent lawyers, and Mr. Louis D. Brandeis, both broad-minded men, both realizing the necessity of reforming our patent system so that an inventor and the public will be more fully protected, were correct in their views. "The right to accumulate patents," as Mr. Fish remarked, "is one thing, the right of a number of manufacturers who own patents to come together and consolidate is another thing." That important distinction seems to have been overlooked. "To meet this situation wherever or whenever it may exist," said Mr. Brandeis, "what is needed is not a law dealing specifically and in this limited way with patents, but dealing broadly with the situation; which is going to cover not only patents, but is going to cover all articles."

The Lesson of the Naval Review

WHEN the President of the United States, amid the thunder of saluting guns, steamed down the far-flung line of warships at the recent Naval Review at New York, the sight was one which might well bring a thrill of patriotic pride to the hearts of the assembled multitude. Twenty-five years ago, when our new navy had its modest beginnings, scarcely a ship of the vast fleet which has just disbanded was in existence. That we have so powerful a navy to-day is due to the generosity of Congress, especially in the earlier half of the period referred to. That our Navy is so strong in battleships is due to the foresight of our Navy Department in putting the bulk of the displacement of its ships into capital vessels, able to take their place in the first line of battle. To-day the United States barely holds its proper position of second in naval strength among the navies of the world, if indeed we have not lost that position to Germany. Battleships are essentially the guardians of the peace, particularly when they do police duty for a nation so rich in resources as our own. Just now, when the growth of the country in wealth and influence is so rapid, there should be a proportionate increase in the number and power of our fighting ships of the first class. The unfortunate action of Congress during the past year has shown how little this fact is realized. The battleship appropriation was cut in half, and when vessels have reached a displacement of 26,000 to 30,000 tons, the cutting down of the programme by one ship represents an enormous loss of fighting strength. If our Navy is to maintain its proper standing, not only will the annual programme of two battleships a year be strictly adhered to, but Congress next year will make good the deficit of this year by an appropriation sufficient to cover the construction of three battleships of the greatest size and power.

The following considerations will show how great is the deficit due to the elimination of one ship. This vessel would in all probability have been an enlarged "Nevada," of 30,000 tons displacement, mounting twelve of the new powerful 14-inch guns, behind armor forty per cent heavier than any carried by the modern ships at the review. Because of her powerful guns, remarkable protection and superior speed, this ship would be more than a match for three ships of the "Connecticut" class, at the great range at which she would elect to fight them.

Seattle and Puget Sound Harbor Improvements

IN the year 1908, when the Atlantic fleet of sixteen battleships steamed into Puget Sound and dropped anchor in crescent formation a short distance from the docks at Seattle, striking evidence was afforded as to the ample depth of water and wide area of anchorage afforded by the harbor. A battleship fully loaded often exceeds a 30-foot draft. An even finer demonstration was afforded when on September 19th last the steamship "Minnesota," the largest cargo carrier on the Pacific, drawing 39 feet 6 inches aft, under her own steam, backed out from her pier, swung into the harbor, and without the assistance of tugs, was soon under full headway for Yokohama, carrying what was probably the largest cargo ever carried by any ship.

These excellent natural advantages [illegible] shel-tered waters, are to be supplemented by extensive costly improvements—the work partly of the United States Government and partly of the [illegible] citizens of Seattle. The part of the [illegible] is represented by a bond issue of $5,000,000, [illegible] used for condemnation of one hun[illegible] acres of the highest class industrial property in the city, and the erection thereon by the Port Commission of a series of piers. These facilities are to be leased to a Terminal Company, which will improve the balance of the ground on a plan similar to the Bush Terminal Company, Brooklyn.

So far as actual harbor improvements go, the Government and the people of the Northwest are spending more than $8,000,000 for waterways, jetties and similar work. The largest project is the Lake Washington Canal, extending from Salmon Bay to Union Bay on Lake Washington. The distance is between four and five miles. The channel will be 100 feet wide at the bottom and from Salmon Bay to Lake Union will be 35 feet deep at low tide; from Lake Union to Lake Washington will be 25 feet at low tide. In connection with this waterway, which will be completed the last of 1914, the Government is now at work upon a huge lock, the second largest in the United States, costing $2,275,000. The lock will be 800 feet long and 80 feet wide, inside dimensions. The right-of-way for this canal cost $250,000, the excavation already has cost about $450,000, and the excavation to complete the canal will cost another million, making a total expenditure of about $4,000,100 for this waterway.

The great value to Seattle of this canal, opening up, as it does, two great fresh water harbors, supplying generous dock space and factory sites, is evident. It increases the water frontage from [illegible] to [illegible] miles. The Government stands a little over one half of the expenditure, the people of Seattle and King County the balance.

Another waterway project contemplated, is the straightening of the Duwamish River. This plan involves an expenditure by the people of that district of about $1,000,000 to construct a straight channel in place of the serpentine Duwamish River, extending south four miles from the harbor. This channel, which will be 18 feet deep, will open up a river front industrial tract now supplied with only railroad transportation.

Other improvements in the Northwest being built by the Government are the Gray's Harbor jetties, costing in all about $2,600,000. The jetty on the south side of the harbor, 14,000 feet long, is completed and of the one on the north side about 13,000 feet is partially completed, and will cost when completed $1,600,000. These jetties are for the purpose of scouring out a bar at the entrance of Gray's Harbor. Seattle, fortunately, has no problem of a bar to contend with.

The Government is also installing training dikes at Everett Harbor and at the mouth of the Snohomish River. These are about three miles long and cost $125,000. The cost of dredging about 600,000 yards of dirt for the channel will cost approximately $80,000 additional. At Bellingham a waterway is being dredged at a cost of about $100,000, involving 800,000 yards of earth. At Willipa Harbor an 18-foot channel is being dredged from the Bay to Raymond, between seven and eight miles, involving the removal of 1,500,000 yards of dirt, and at a cost of $115,000. At Olympia, a waterway on the west side of the harbor is being widened from 100 to 200 feet at a cost of $40,000. The Port Commission has a scheme of dock improvements involving four or five municipal docks, including a large timber dock for the handling of the timber shipments of the entire Puget Sound country.

Exposition Relating to Accident Prevention

A PERMANENT exposition, which should be of interest to inventors, has been opened in Copenhagen and has for an object to exhibit the latest devices and measures to prevent accidents and injuries to workmen. It is projected by the Danish Association for the Protection of Workmen, and is aided by the factories and firms furnishing the apparatus. It contains exhibits looking to the prevention of accidents by power raising, transmission, and working machines, as well as measures looking to the carrying through of regulations relating to factories; also statistics and literature. It includes an exhibition of water gages illustrating measures to be taken in attending steam boilers, and an instructive collection for the enlightenment of the worker on dangers incident to steam boilers. The protection of workmen consists not only in means for protecting them from mechanical injury, but also the improvement of conditions generally looking to their health, such as a sanitary condition of the premises, ventilation, insurance against accident and illness, and it is the intention to change the exhibits from time to time so that they will illustrate advancements which may be made toward the end in view.

Electricity

[illegible]ing for Outdoor Comfort.—Policemen of [illegible] stationed at street intersections all day [illegible]eather, are coming in for consideration [illegible] in Indianapolis. That city has appro[illegible] installing at twelve downtown street [illegible] steam-heated "manhole," on which the [illegible]an stand to keep his feet warm.

[illegible] the Textile Industry.—A large percent[illegible]ut of the textile industries in France [illegible]estic workshops, and at Lyons alone [illegible]nds of workmen thus employed. Elec[illegible]oming into use extensively, and are well [illegible] purpose, and on this account there is a [illegible]andon large works in favor of domestic [illegible] Isere region where large factories were [illegible]890, there are being installed small shops [illegible]hich are run by electric motors.

[illegible]Signals in Switzerland.—The time signals [illegible] Eiffel Tower are received not only in [illegible] also in Switzerland, where a number of [illegible] are being set up for the purpose. This is [illegible] in the watch-making district where the time signals are useful. The steeple of the Payerne church serves for a post which M. Blankart has installed, and he uses wires 85 feet long stretched from the top of the spire to four points below. He is able to receive the signals from Paris at a distance of 270 miles with a very simple wireless apparatus.

Electrical Christmas Gifts.—Electricity contributes a surprising number of gift articles for serious use, for convenience and for amusement—a considerable increase for the holiday season of 1912. A recently published list comprises over 125 of such special articles in which small amounts of electric current are transformed into light, heat or power, the varying applications showing the extent to which electricity has entered home life. Electric heating and cooking devices and appliances for saving labor in the household head a list of "gifts for women." Then there are about thirty electrical toys for children, appealing mainly to boys, of course. Over twenty other articles suitable for men are made, and almost as many again for bedroom and nursery comfort.

The Giant Condensers Required for Steam Turbine Generators.—The importance of the condenser to the efficient operation of the high-capacity steam turbine generators which are now so generally used in large electric central stations is well illustrated by the new apparatus in Chicago's latest electric generating station, the "Northwest Plant," designed for an ultimate equipment of 240,000 kilowatts. In the turbine room there are installed at present two 20,000-kilowatt vertical units, and the turbine-base condenser of each unit contains 7,500 one-inch brass tubes 17 feet long. The total effective condensing surface of 32,000 square feet thus provided is designed to maintain a two-inch vacuum when condensing 280,000 pounds of steam per hour. The main condenser shell weighs 141,000 pounds.

Color Decorative Lighting at the Boston Electrical Show.—The electric light decoration for the exterior of the Mechanics' Building, Boston, where the Electrical Show opened on September 28th, includes some novel and beautiful features carried out under difficulties. The walls of this building are covered with ivy (the growth of many years) which could not be disturbed, so the special decorative effects obtained by incandescent lamps are supported on falsework extending to the ground. These effects include mosaics of conventionalized flowers and foliage, in 4 and 8 candle-power lamps with dark red, light red, amber, dark green and light green bulbs. In addition, a number of decorative lampposts bearing flame arc lamps in groups of four are used, the group comprising a single pale-green lamp above and three pale rose-red lamps below. Pairs of pylons at the two ends of the street on which the building stands carried thirteen flame arc lamps each, the lamps in the two upper tiers being pale-green and the remainder rose-pink.

The Incandescent Lamp in New York Thirty Years Ago.—The New York Electrical Exposition held October 9th to 19th emphasizes the historical side of the electrical industry, especially the vast development of the public incandescent electric lighting service in New York city. This service to-day—well over 5 million actual lamps aggregating about 10¼ million 50-watt equivalents served from two gigantic central stations and 31 substations over 1,292 miles of underground mains and feeders—is the outgrowth from the original Pearl Street station, where the current was first switched on at 3 P. M. September 4th, 1882. Of the six "Jumbo" 125 horse-power dynamos which in that "day of small things" served 400 lamps, distributed among 59 customers, all but one was destroyed by fire in January, 1890. The one dynamo that was saved is now treasured as a relic; its work is done to-day largely by steam turbine generators of capacities up to 30,000 horse-power in a single unit. This original machine will be brought to the exposition from its honored retirement, and a model of the original central station will also be shown.

Science

Passing Gases Through Iron.—It has been known for some time that gases will pass through metals when they are highly heated, thus platinum at a red heat will allow air to pass through it. Iron is also permeable for hydrogen when hot and even when cold to a certain degree. More recently, Charpy and Bonnerot show that nitrogen does not penetrate iron below a temperature of 800 deg. Cent. Hydrogen passes more easily, and at a temperature of 500 degrees a considerable action is noticed.

New Monetary Standard.—At the Science Congress held at Nimes, France, a report made by M. Gobin was adopted, namely that a monetary standard be used by all countries which is adapted to the values now in use. The unit is known as the "mono" and has the value of $0.05. It corresponds to the well-known monetary units as follows: Franc, 4 monos; mark, 5 monos, florin, 8 monos; shilling, 5 monos; piastre, 10 monos, yen, 10 monos; lire, 4 monos; peseta, 4 monos. The dollar would correspond to 20 monos.

Prof. Lewis Boss, Professor of Astronomy in Union College and Director of the Dudley Observatory, Albany, died at his home in Albany at the age of 66. Prof Boss was director of the Dudley Observatory for thirty-six years. Prior to that, from 1872 to 1876, he was the astronomer of the Northern Boundary Commission. He headed the United States Government expedition to Chile, in 1882, to observe the transit of Venus. Recently he has been director of the Department of Meridian Astronomy in the Carnegie Institution. He was a member of the National Academy of Science and foreign associate of the Royal Astronomical Society

The Care of Books.—Persons about to install new libraries, or those who find their books in bad condition, will be glad of the advice offered on this subject by a writer in *Les Annales* (Paris). Glass cases should always be avoided, except for a few precious volumes which are specially looked after and frequently dusted, since the confined atmosphere and lack of air-circulation in such bookcases is favorable to the development of germs, insects, and mold. Secondly, the simple precaution should be taken of placing on the shelves behind the books strips of cloth or flannel moistened with benzine, phenol, tobacco juice or turpentine. These strips give excellent results if renewed from time to time.

Infantile Paralysis Spread by Stable Fly.—Infantile paralysis is transmitted by the stable fly is the important discovery which Dr. M. J. Rosenau, professor of preventive medicine and hygiene at Harvard, announced to the fifteenth International Congress of Hygiene and Demography. Dr. Rosenau experimented with monkeys, the animals most closely resembling man. Twelve monkeys were infected with infantile paralysis At different stages of the illness a large number of stable flies were introduced into the closely screened cages containing the monkeys. The stable fly bites. After a certain period the stable flies were transferred to cages containing well monkeys. These animals after being bitten by the flies developed all the symptoms of infantile paralysis, just as they appear in children afflicted with the disease. Some of the monkeys died. Dr Rosenau took tissues from the monkeys thus infected by the flies and injected them into a third set of monkeys, which thereupon developed the disease. A method for eradication and control of infantile paralysis is now placed in the hands of sanitarians. It is believed that the necessity of quarantine is thus relieved, and that it will suffice to place a bed net around the patient.

A Kinematographic Study of Street Conditions.—At the Cities Exposition held recently in Duesseldorf, Germany, the perils of street traffic were illustrated in a convincing manner by means of kinematographic pictures made by the Duesseldorf Street Railway Company. Everybody knows that it is dangerous to board or to alight from a moving car. Statistics show that nearly fifty per cent of all street railway casualties are due to this foolish practice. One film showed a woman alighting from a slowly-moving car in the usual careless manner and coming to grief in consequence. In contrast was exhibited a film bearing the device "The Left Hand on the Left Handle" and showing a woman alighting properly and safely. A third film illustrates the danger which a person walking, driving or cycling behind a car incurs by shifting to the other track without assuring himself that his new course is clear. The film shows a bicyclist turning to the left from behind a car and colliding with an automobile moving in the opposite direction. Another film illustrates the notorious bad habit of truckmen and hackmen, who persist in obstructing the tracks in defiance of the warning gongs and whistles of overtaking trolley cars. This obstructive policy of drivers should be combated by energetic measures. It is intolerable and absurd that thousands of persons should be delayed daily in this age of haste by the selfish obstinacy of a few drivers. The time-saving and other advantages of the new type of street car, in which the exit is separate from the entrance, are also shown by comparative kinematographic studies.

Automobile

Special Cars for Hunting Dogs.—Owners of large estates in England have purchased a new style of motor truck, which is especially designed for the transportation of hunting dogs to and from the rendezvous. One of these trucks will carry ten dogs, each in a separate little "stall."

A Gasoline Tank for Automobiles.—Howard E Coffin, the well-known automobile inventor of Detroit, Mich, has secured a patent, No. 1,039,098, for a tank which has a hollow partition dividing it into compartments, and the tank is provided with means which will indicate any leakage from either compartment into the hollow partition.

Number of Cars in Germany.—According to statistics just issued by the German government, there are at present 43,000 passenger cars, 7,000 motor trucks and 20,000 motorcycles running on German roads This is considerably less than in half a dozen American States, and barely half of the number in use in New York State alone

Venezuela Opens Automobile Line.—The Minister of Public Works at Caracas has granted a franchise to some promoters who are planning to run an automobile 'bus line from Valencia to Nirgua The cars, which will be used for both passenger and merchandise transportation, are to be admitted free of duty Active operation is to begin at once.

A Yielding Tire Filler. There appears to be considerable interest in the provision of yielding fillers for tubular rubber tires William Edgar Howser and Albert M Woltz of Greensboro, N. C, have patented, No 1,038,891, a tire filler which consists of pulverized cork, sulphur and corn oil with the proportion of corn oil about three fourths of the entire composition

Blow-out is "Higher Power." -French courts have just decided that when an automobile tire "bursts" it is the influence of a "higher power," in the sense of the French law, which frees the perpetrator of any injury from responsibility for damages caused A touring car "blew" a tire, and crashed into a store window A lawsuit followed, and the storekeeper lost, because the "higher power" clause was applied.

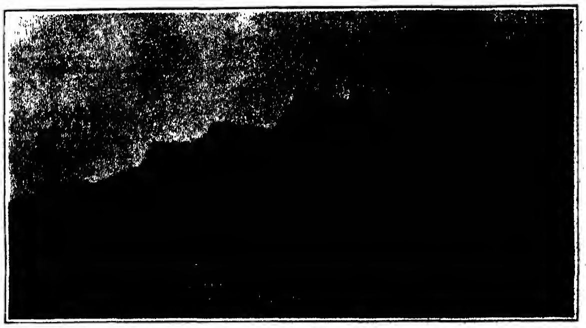
Berlin Forbids Chauffeurs to Smoke.—Declaring that the habit of smoking cigarettes or cigars, while in charge of an automobile, was responsible for many accidents, the municipal authorities of the city of Berlin, Germany, have forbidden chauffeurs to smoke while on duty. The order applies not only to all chauffeurs driving taxicabs but also to anybody, whether prince or peasant, who sits at the steering wheel of a motor car. The rule has caused extraordinary excitement, but it is enforced with impartial severity

Intercity 'Buses for Canada.—As it would not pay in many of the provinces of Canada to build railroads for the present comparatively small traffic, it is planned to establish in all parts of the country automobile 'bus lines, connecting the various cities and villages. For this purpose a $10,000,0000 company, called the Canadian Autobus Company, has been formed and a large number of 'buses are to be installed at once. One million dollars are to be spent in Montreal alone, and other cities are to get proportionate amounts

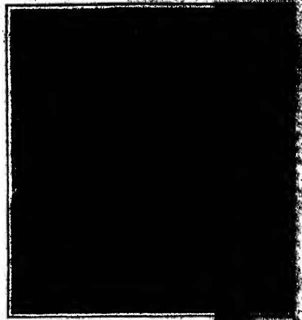
French Courts are Strict.—How important the proper observance of traffic rules seems to the French is best shown in the decision of the highest French court in the case of a motor truck which was not properly lighted in the rear. A passenger automobile ran into the truck on a dark night, and the negligent driver of the truck was sentenced to imprisonment, to pay the damages to the passenger car, to pay for injuries received by the chauffeur and, finally, to reimburse the owner of the passenger automobile for the inconvenience caused by the loss of the use of the car.

Nitroglycerine to Drive Automobiles.—Every now and then somebody comes out with a staggering proposition to increase the power of automobiles The latest plan, thought out by a Houston (Texas) man, provides for the use of nitroglycerine as a power producer The explosive has been used before in schemes like this, usually to the great sorrow of the relatives of the inventor, but the latest nitroglycerine motor is not designed for pure explosive, but for a solution of it in gasoline. The inventor admits that his motor needs more "development" but is sure of "ultimate success"

Belgian Automobile Show. The Twelfth Belgian Automobile Show is to be held at Brussels in the Cinquantenaire Palace from the 11th to the 22nd of January next. The exposition is an international one, and there are ten general classes of exhibits, automobiles and chassis complete; motors and accessories, tires; carriage work; power wagons including either heavy or light weight cars for handling all kinds of freight The other classes include stationary motors or groups, machine tools, agricultural automobiles, aeronautics and the like. It is expected that the show will bring out a large number of exhibits.



Four-room, two-story frame houses erected by the Indiana Steel Company for employees in Gary.



Tinplate Company's [illegible] house of solid concrete [illegible]

Concrete Houses Versus Tenements

Model Dwellings for Workingmen

By Marc N. Goodnow

ELEVEN New York city blocks have a density of 1,200 people per acre, which means that if the whole of little Delaware were similarly crowded, it could contain the entire population of the world, white, black, yellow and red. This almost inconceivable city congestion means, further, that these people must live in tenements, where they are compelled to stunt and warp their own and their children's lives to fit the space requirements of their foul surroundings.

Many cities smaller than New York can boast of congestion among their sweated or factory workers, which though not so great in density is none the less inexcusable in the light of the greater space over which these cities might easily spread. Where cities have grown up about large industries under the misguidance of real estate speculators, housing conditions generally are distinctly bad. Where the industry itself has had foresight enough to prevent crowding or capital enough to build houses for its employees, some effort has been made to get away from this state of human congestion.

An example of the use of concrete as a weapon with which to exterminate the evils of crowded housing and city congestion is furnished at Gary, Indiana, where the American Sheet and Tinplate Company is completing fourteen buildings of monolithic concrete, costing something over $130,000, and furnishing apartments and houses for seventy-four families of workmen in its local mills. These are the beginning of a group or settlement of houses planned to accommodate eventually from 250 to 350 workmen's families.

By improving upon former methods of pouring concrete into wooden or metal forms, the company has gone a long way in solving a knotty problem—that of housing employees in inexpensive yet durable houses which can be grouped together in an attractive manner, and low enough in cost for these same employees one day to buy. The same design was carried out in the same community by the United States Steel Corporation, which erected frame houses and afterward disposed of many of them to employees on the monthly payment plan.

Estimating the cost of the finished apartments and houses at $133,000, that of a single dwelling would figure as low as $1,803, which, in Gary at least, is a comparatively low sum. The detached houses, of course, would approximate at least $2,750 each, and more in a number of instances. But tinplate employees average a higher wage than steel mill employees, and their purchasing power, consequently, is somewhat larger.

The present investment of the tinplate company stands at close to $200,000 for equipment, forms, materials and labor. Its forms cost approximately $40,000, and have been used in the construction of the following houses and apartments:

Six houses at $2,750 each	$16,500
Three ten-apartment houses	49,000
Two ten-apartment houses	32,500
Two four-apartment houses	13,000
One three-story ten-apartment house	22,000
Total cost	$133,000

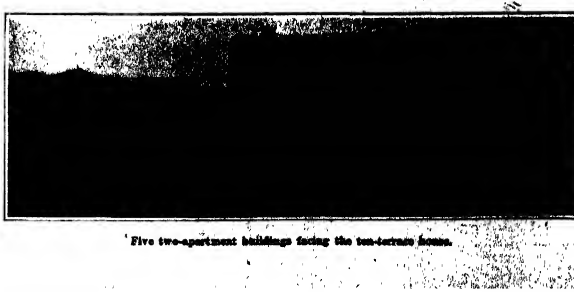
These buildings are provided with all modern conveniences and sanitary essentials. Mantelpieces and buffets are made of concrete, as well as w[illegible] drains and gutters. The detached houses, t[illegible] in height, are provided with shower baths. [illegible] are of concrete, wood or composition. The [illegible] composed of tile or gravel and tar.

The exterior ornamentation also is formed [illegible] concrete. In fact, every feature of a house which can be built of indestructible material is so constructed. A variety of architecture which is not unpleasing to the eye has been secured, and the settlement is far more attractive than long rows of tenement houses. The "ten-terrace" houses, with accommodations for ten families, are a departure from the set rule of workmen's cottages. They follow more closely the style of the Philadelphia house, and in Gary contain seven rooms, four on the first floor and three on the second. In the three-story terrace houses, each apartment has nine rooms.

The Edison plan for monolithic concrete construction—that of large molds of steel into which the liquid stone is poured—has been improved upon in the newer "sectional" forms used by the tinplate company. These sectional forms and their accessories in the process of "setting up" number 28,000 separate pieces and comprise the equipment for as many as twenty different styles of house, each varying in architecture. The frames or sections are composed of durable sheet steel and constructed with flanges which can be clamped together to form a continuous wall or floor. With the foundation section in place a force of workmen sets each section on top of the previous one until the required height of the first wall has been reached. Each floor becomes a separate entity; in fact, each room is an entity, surrounded completely by concrete reinforced with bars of steel or mesh wire. The interior and exterior surfaces are later smoothed and pointed, then painted, calcimined, plastered, sand-blasted or tinted, according to the plan of the architect, and the artistic effect he desires to produce.

These houses and apartments are built to rent for from $12 and $15 to $20 and $30 a month. They are within walking distance of the company's

Kirk settlement-houses erected by the Elgin, Joliet & Eastern Railroad for its employees at Gary.



Five two-apartment buildings facing the ten-terrace house.

[illegible] are placed south of the smoke which comes [illegible]. There are about these houses ample [illegible] garden plots, fresh air and sunshine. Their [illegible] are not cooped up on a single floor with no [illegible] area and no sanitary provisions. There are [illegible] for summer social advantages and play room [illegible] children. These concrete houses are in strange [illegible] to the flat-congestion which prevails on Gary's [illegible] side, among the poorer working [illegible]. There it is not unusual to come [illegible] forty people living and sleeping in [illegible] flat. The new houses, in fact, are in strange contrast to the cheaper [illegible] houses erected by the corporation for its steel mill employees and [illegible] as "Hunky Row." These frame [illegible] soon became a fester in the city [illegible] crime and immorality, and have finally [illegible] condemned by the corporation. They [illegible] to be replaced by a better class of [illegible] probably of concrete.

Of course, there is one big objection to houses of this kind under the present conditions. The man and family who really need such advantages most are the ones who in a great majority of cases cannot afford to pay the price. Further than that, there is very often a class distinction which makes itself painfully apparent on occasion, and the day laborer often prefers to remain among his own kind. By constructing houses for the different grades of workmen (the basis being their salaries) on the same streets, the steel corporation overcame a large measure of this purely fictitious valuation. In a number of instances it was found that the day laborer "sandwiched" in between two foremen or superintendents was benefited greatly by thriftier examples ahead of him. The tinplate company is endeavoring to do the same thing in its houses and their location.

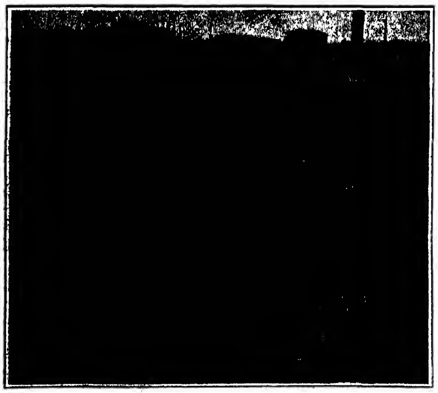
While we must commend the policy which has governed the building of these workingmen's dwellings, we cannot refrain from pointing out how much better these things are done in Germany, at least from an artistic point of view. The German town of Essen may be compared with the American town of Gary; for at Essen the enormous cast steel works of Krupp are located. The Krupps first began to build workingmen's dwellings in 1861. At first, tenement houses were erected, but in 1894 (in Alfredshof) the cottage system was adopted. So far as external appearances are concerned, there can be no doubt that these Krupp cottages are far more attractive than the houses at Gary. Between 1871 and 1874, over six million marks ($1,430,000) were spent by Alfred Krupp to provide housing for 2,400 families. The architectural efforts of that period in Essen were no more creditable than those at Gary. It was not until the Krupp works began to develop rapidly during the nineties of the last century under the directorship of the late F. A. Krupp, that the problem had to be attacked anew. In old Alfred Krupp's day, the chief problem to be considered was that of providing cheap dwellings, so that even the poorest workingman might have a chance to save money. When F. A. Krupp assumed the directorship, it became a serious matter to provide adequate dwellings for hundreds of families. There were no adequate accommodations in Essen. They had to be created. This he did, from a utilitarian as well as from an æsthetic point of view. Twenty minutes southwest of the cast steel factory of Essen lies his colony of Alfredshof. It was built between 1894 and 1899, and comprises about two hundred and fifty structures for one, two, three, and four families. Each house lies in the midst of a small garden; each has a small veranda. Although the Krupps were compelled to abandon the cottage system because Alfredshof could not be further extended, and because the town of Essen had grown so rapidly that real estate became very costly, the idea of housing workingmen in attractive dwellings was not abandoned. It was necessary to return to the tenement system, but to tenements designed with such good taste and provided with such admirable sanitary arrangements that it is hard to believe that they are intended for the moderately paid workingmen of a cast steel works.

Source of Commercial Divi Divi

DIVI DIVI is the trade name for the seed pods of a small leguminous tree botanically known as *Caesalpina coriaria* Willd., a native of tropical America and the West Indies. Its natural range has been increased both to the north and south by planting. It grows sparingly in southern Mexico, but it is more abundant throughout Central America, Colombia, Guianas, Venezuela, and the northern part of Brazil. Under favorable conditions of growth it attains a height of from 15 to 30 feet and produces an immense number of small yellow flowers which resemble those of the laburnum tree (*Cytisus laburnum* Linn.), which is planted frequently for ornament in this country. These flowers are soon followed by dark glossy-brown pods, which vary from one to three inches in length and are about two thirds of an inch in width. These pods, which are at first straight, soon curve or bend like the letter C, but when they are fully matured they curve like the letter S. They are filled with a yellowish powdery substance and with a few dark-colored seeds. The seeds have no commercial value, but the yellowish powder contains as much as 50 per cent of tannin, which causes it to be used extensively for tanning purposes. The tannin derived from these pods differs materially from that obtained from oak bark or galls. It is said that one part of divi divi is sufficient for tanning as much leather as four parts of that from oak bark and the process occupies only about one third of the time. Tanners seldom use divi divi tannin by itself, but they generally mix it with oak bark and valonia (acorn cups of *Quercus aegilops* Linn.). Leather produced by this means is used principally for soles.

A glimpse of the workingmen's colony at the Krupp cast steel works at Essen.

Modern tenement houses of the Krupp workingmen's colony.



Preparing to set forms on the basement floor.

The divi divi tree has recently been introduced into other tropical countries, but only to a small extent. In the East Indies its cultivation has been most extensive and successful. Although divi divi is produced naturally in enormous quantities, a need has been felt for artificial propagation of this tree, especially in regions where it is not native. Divi divi is at present grown for commercial purposes in Java, Ceylon, India, German East Africa, and other parts of tropical Africa. It is also cultivated on a small scale in the West Indies, especially in Jamaica. The cultivation of this tree is simple, and the yield is often very large. Since the demand for divi divi is so great, it seems advisable to recommend its planting in all countries that have soil and climatic conditions in which this tree admits of being cultivated. That it can be grown profitably on a large scale in the American tropics simply for the sake of its pods is doubtful, on account of the lack of efficient labor. It can be cultivated, however, as a minor crop in a banana, sisal, or cocoanut plantation. It is also an excellent tree for shade or for wind break.

An experimental plantation was made in Dar-es-Salem, German East Africa, in 1901, and the first crop from these trees showed that the results were entirely successful. An experienced planter from tropical Africa writes that divi divi in German East Africa thrives from sea level to 2,500 feet elevation. It begins to bear in the fifth or sixth year, depending upon the character of the soil and climate, and retains its capacity for production up to the twenty-fifth year. A thrifty tree is said to produce a quantity of pods valued at about $3.25. The amount of pods produced annually by a full grown tree is about 100 pounds; by deducting 25 pounds for seeds and refuse matter, 75 pounds of good tanning material are left.

Divi divi is reproduced wholly by seed. A seed bed is prepared by mixing with the soil thoroughly rotted manure in the proportion of 2 to 1. The seeds are then placed 8 inches apart each way and about 3 inches deep. The bed must be properly shaded, at least during the hottest part of the day, and the soil must be kept constantly moist. In about ten days the young seedlings will appear above ground, and when they are about 4 or 5 inches high, shading may be discontinued. Nor will it be necessary to water the seedlings regularly every day unless the weather is very hot and dry. When the young trees are about a foot high they are carefully transplanted to their permanent places. The young trees are set 12 feet apart each way. In case the transplanting is done during very dry weather it will be necessary to water the plants daily until they all have taken root and are thriftily growing. They must be partly shaded during the first three months. The care required thereafter consists simply in keeping down weeds until the trees thoroughly shade the ground, which is about the time when they begin to bear fruit.

The pods are picked off when they are deep brown, dried thoroughly in the sun and packed in bags for shipment. The principal countries from which the American tanners derive divi divi are Colombia and Venezuela. Although small amounts are grown in the Guianas, Brazil, and in parts of Central America, it is not imported into this country.

The Barocyclonometer

By C. F. Talman

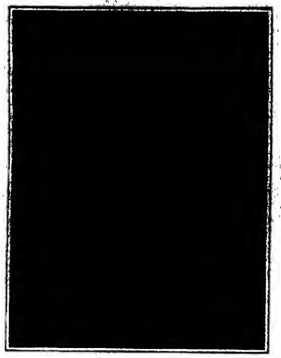
THE dreaded hurricanes of the West Indies are about to become a more important factor in nautical affairs than they have ever been before, in view of the diversion of trade routes to the Caribbean Sea which is to follow the opening of the Panama Canal. The attention of our Government has been directed to the necessity of a renewed study of these disturbances and the means of protecting vessels from them. The Weather Bureau has now in the press a bulletin on this subject, from the pen of Dr. O. L. Fassig, lately in charge of the meteorological station at San Juan, Porto Rico. Moreover, it is understood that the same Bureau is planning the establishment of several new shore stations in the West Indies, and has already engaged the services of special marine observers aboard vessels in the West Indian trade, who now send twice-daily reports by wireless telegraphy to Washington. Similar considerations have led the Navy Department to adopt for use on the North Atlantic a device called the barocyclonometer, which has proved of great value to mariners in the Far East in determining the proximity of typhoons.

This instrument was invented by the Rev. José Algué, S.J., director of the Philippine Weather Bureau, in 1897. It may be regarded as the outgrowth of several earlier and relatively crude devices for enabling mariners to locate the direction of a neighboring hurricane from local observations, viz., Piddington's horncard, Reid's storm-card, Lloyd's typhodeictor or storm-pointer, Viscovich's cyclonograph, Viñes's cyclonoscope, etc. All of these devices depend upon the fact that the winds around a tropical cyclone have a definite relation to the position and movement of the center, and hence to the state of the barometer.

The barocyclonometer is a signal improvement over its predecessors because it takes account of the fact that the normal barometric pressure—a marked departure from which gives token of a neighboring hurricane—is not the same for all parts of the ocean or for all seasons. It consists of two principal parts, as shown in the accompanying picture, which represents the form of the device now used in the waters of the Philippines and the China Seas. To the left is seen a special form of aneroid barometer. The barometer proper occupies the center of the dial, and is graduated in both metric and English units. Surrounding this is a flat ring of silvered brass which is movable around the barometer dial. The first step in the use of the instrument is to set this ring in accordance with the indications printed on its lower half. For each zone of latitude and for each season there is a definite pressure above which the conditions may be regarded as normal, i. e., if the pressure is *above* this limit, at the place and time in question, the mariner can be certain that no cyclone exists within a radius of 500 miles. The ring is turned until a red arrow, shown to the left of the segment marked "Variable," points to the reading of the barometer dial corresponding to this normal pressure. If, when the instrument is thus adjusted, the index of the barometer points to a reading to the left of the red arrow, the vessel must lie within a cyclonic area. The segment of the ring marked "typhoon" will then embrace all readings likely to occur within the cyclone. The latter is divided into four concentric zones, *A*, *B*, *C*, and *D*, at various distances from the center of the storm. Having ascertained from the barometer the proximity of a storm, it is of the utmost importance to know in what direction the storm center lies from the ship and the direction in which it is traveling. This is determined by the use of the cyclonometer, shown to the right. The glass face of the cyclonometer is immovable. It is marked at its circumference with the points of the compass and with eight diametrical lines engraved on the glass. Beneath the glass cover is a metal disk which can be revolved by a knob at the center. An arrow passing through the center of this disk (only the point can be seen in the picture, close to the knob) represents the direction of the storm's movement. The other little arrows engraved on the disk show the direction of the winds around the center, as determined by innumerable observations of such storms. These winds have a general right-to-left rotation around the storm, and are also inclined more or less toward the center. The concentric circles seen on the disk mark the limits of the four zones of the storm, *A*, *B*, *C*, and *D*.

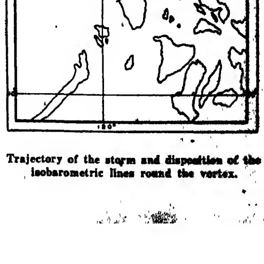
The two long needles pivoted at the central knob and movable about it are called the "graduated needle" and the "double needle." The former has the inner two thirds of one of its halves [illegible] 200; the latter has a smaller [illegible] thirds the distance between the center [illegible]. Either of the large needles may be used [illegible] first approximation of the direction of the [illegible] ter. Having ascertained from the barometer [illegible] zone the ship lies, the disk of the cyclonometer [illegible] turned so that the central arrow points in the [illegible] direction of a cyclone's path for the place and [illegible] in question; the needle is then set so that [illegible] points to the outer end of the wind arrow [illegible] corresponding to the direction of the wind [illegible] at the ship, and lying in the appropriate zone; the other end of the arrow will then indicate the [illegible] point corresponding to the direction of the storm [illegible] from the ship. The use of the second needle involves a somewhat complicated operation, of which space forbids the description here. It is fully explained in A[illegible] work on "The Cyclones of the Far East."

Several modifications will be made in the instr[illegible] to adapt it to the barometric and wind condit[illegible] the North Atlantic.

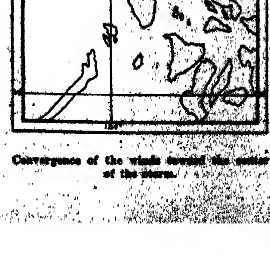


Father José Algué, S.J., director of the Philippine Weather Bureau and inventor of the barocyclonometer.

An instrument that indicates the proximity of typhoons.



Trajectory of the storm and disposition of the isobarometric lines round the vertex.



Convergence of the winds toward the center of the storm.

Solid Oil as a Marine Fuel

THE question of a solid fuel for ocean liners in the shape of solidified petroleum is being taken up of late in Europe, and the outlook for this kind of fuel seems promising. Tests have been made in many countries with spray fuel burners, but when it came to actually applying these on shipboard an obstacle arose, as the new method would lead to a radical transformation of the existing apparatus. Not only are special oil burners needed for the furnaces, as well as regulating appliances, but the devices for loading the liquid combustible on board would need to be changed. Besides, great storage tanks are needed for the liquid, and the action of the latter upon the walls of the tanks would be strongly felt when the vessel is rolling at sea. It was decided quite recently at an important meeting of shipowners at London to go into the production of solidified petroleum brickets on a large scale. These are obtained without any great chemical manipulation. The crude oil is boiled and to it is added a certain amount of stearic acid with an alcoholic solution of caustic soda. Upon cooling, there is obtained a transparent mass somewhat resembling glycerine soap, and it has sufficient cohesion to allow of making it into square-shaped brickets. These are easy to handle, as they are not brittle nor do they cause dust. Such blocks have a slow and very regular combustion owing to their uniformity of structure. The weather does not seem to affect them, and they always remain clear. Even boiling water is said to have no effect on the brickets. The heat production from them is such that a ton of solidified petroleum serves instead of 2½ tons of coal. The great saving of space on shipboard is evident, and another point is the great all-around economy realized for producing an equal amount of steam. Some British naval engineers studied the question and concluded that for a single trip of a Cunard liner from England to New York and return the lowest figure for the saving would be $60,000. They also reported the following points in favor of the new fuel: 1. No appreciable modification of the furnaces or bunkers is needed. 2. The brickets burn very well in open furnaces. 3. They have a very high calorific power. 4. No inflammable gas is given off under the action of heat in the furnace. 5. They burn slowly without running of liquid, nor is there any crackling or explosion. No ash is left. 6. Their regular shape facilitates storing, and there is no space lost. 7. The brickets harden with time and reach a great crushing resistance. 8. The range of the vessel will be much increased, which is a capital point for war vessels. From another point of view, it is held that the navigation companies will be more inclined to increase the speed of the ocean liners, since they are able to obtain high steam pressure at a much less cost for fuel than before. On the whole, the new method appears to be a promising one, and a great success is predicted for the solidified petroleum owing to its low price, and its adoption may prove to be rapid in the near future, for liquid petroleum would only be able to replace coal in a gradual way, owing to the great cost of changing over furnaces and bunkers.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Peck's Death Not Due to Gyroscopic Action

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Brooke's arguments on Paul Peck's fatal flight, which appeared in the SCIENTIFIC AMERICAN of September 28th, 1912, are based on false premises.

Mr. Simmons, the builder of the aeroplane, and myself were present and watched Peck, and we observed that before he began his spiral dip *he shut off the motor* (as he always did before volplaning) and consequently no gyroscopic action could have developed during all the time he came down.

If Mr. Brooke wishes to take a stand against revolving-cylinder motors, let him at least stick to facts and not stimulate his imagination into twisted arguments and fallacious conclusions. R. S. MOORE.

Washington, D. C.

The Columbia River Jetties

To the Editor of the SCIENTIFIC AMERICAN:

J. F. McIndoe, Major, Corps of Engineers, U. S. A., makes the following statement *in re* south jetty, mouth of Columbia River, in SCIENTIFIC AMERICAN of October 5th, 1912: "It is confidently expected that it will be completed in the early spring of 1913 and that its maintenance will not require the dumping of more than a small amount of rock in the next few years, while the trestle remains serviceable," etc.

In the annual report of the Chief of Engineers, U.S.A., dated October 14th, 1911, Major McIndoe says: "The revised estimate, approved April 17th, 1909, for the completion of the south jetty was $3,529,300, and is based on a report made by the district officers, recommending that the jetty enrockment be raised to at least mean tide level, and that its crest be given a width of not less than 25 feet, in order to protect the trestle piling from early destruction by storms and teredo. The increased cost is due to the greater amount of stone required, the increased cost of materials, and the heavy loss during construction in previous years, due to destruction of the trestle by winter storms and teredo. In some places the jetty is being built in depths as great as 39 feet, and with 15 feet increase in the width of its crest, it becomes at once evident that an enormous increase in the amount of rock is required. . . . The life of the trestle is very uncertain, and the work of reinforcing the rock must be done before the trestle becomes unserviceable. . . . Amount required for expenditure in fiscal year ending June 30th, 1913, $1,000,000."

Major McIndoe, of course, has the right to revise in September, 1912, what he wrote in October, 1911. It is a habit with Government engineers to make such revisions periodically, and no doubt the next Congress will be officially informed that the south jetty is completed, and that instead of requiring nearly four million dollars more, not another cent will be needed. Major McIndoe, however, must not blame publicists for using the data he presents to Congress in order to get constantly and enormously increasing appropriations, in preference to data he keeps in stock for local use.

Personally, I do not feel at all concerned by his denial of some statements I made in the SCIENTIFIC AMERICAN in describing the jetty work at the mouth of the Columbia River. My statements therein are his statements to Congress and my deductions therefrom are the inevitable conclusions from his statements and are merely conclusions. These deductions refer to the time it will take to create a 40-foot deep channel at the mouth of the Columbia River and they, of course, are fallible, being deductions. Facts, however, are infallible, and here are the facts on which my deductions were made, from page 1016 of his report:

"South jetty commenced 1885," 27 years ago. "Depth of water at bar, 19 to 21 feet. Depth of water in 1895, with 4½ miles of jetty done, 31 feet, and in 1899, 28 feet. By 1902 the depth had deteriorated to 21 feet," where it was 17 years previously. "The maximum of 1910 was 26½ feet and of 1911 was 27½ feet," an increase of 6½ feet in nine years. The deduction is that at his present rate of increase stated it will require 19¾ years to secure 40 feet depth.

It may be that Major McIndoe will succeed, if he can spend $1,000,000 in that time, in completing the south jetty "in the early spring of 1913," but it will be what is termed the 1905 project, with 7½ miles of trestle work, if the teredo does not destroy it, and rock work up to low-tide level. Meantime, as stated above, the Major has an iron in the fire and wants $4,000,000 to boost the rock work up to mid-tide level.

New York. W. H. BALLOU.

[We are informed by the engineers on the work that it will require not to exceed six years to build the north jetty; and that this will place the time in which Portland can hope for a 40-foot depth at not to exceed seven years, at the end of which period, they assure us, both jetties should be completed.—EDITOR.]

The New York Electrical Show

THE New York Electrical Exposition, popularly known as the "Electrical Show," held this year in the new Grand Central Palace, October 9th to 19th, is an advance over former shows in the demonstrations of actual devices and in the educational exhibits setting forth the increased utilization of electricity. A distinctive feature of the present show is the presentation of the historical side of the electrical industry. It was just thirty years ago that the first Central Station for providing public incandescent electric lighting service in New York city was put in operation by the initiative of Mr. Edison, and very largely by his personal labor; and this year's show was fittingly opened by a luncheon given in his honor.

Heating and cooking devices have always been much in evidence at the Electrical Show, and this year the variety and ingenuity of these articles is greater than ever. Among them are an egg boiler, itself of attractive egg shape and holding five or six eggs at once, a samovar with removable tea-ball, a frying-pan that may be turned upside down for making griddle cakes, and a combination utensil by means of which one may prepare an entire breakfast—cooking a cereal, making toast, boiling or frying eggs, and broiling bacon, steak or chops—by changes and combinations of the movable part. Complete electric ranges show a remarkable advance over last year. A large space is given up to a tea room for visitors, with many little tables where electrically cooked viands are served.

The United States Government is well represented. Exhibits are made by the Census Bureau of tabulating and statistical machines, by the Bureau of Mines of mining apparatus and of an oxygen resuscitating equipment for miners, by the Reclamation Service of photographs of the arid lands of the West in their original desert state and after irrigation and of the vast engineering works for providing hydro-electrically generated power and irrigation, by the Navy Department, the Bureau of Navigation, the War Department, the Army Signal Corps, and by several Bureaus of the Department of Agriculture. The Electrical School of the Brooklyn Navy Yard has a striking exhibit with the bluejacket students in attendance and including a 20-kilowatt wireless telegraph installation with which the first wireless message will be sent to the Panama Canal. The Isthmian Commission provides a large operative model of the Gatun Dam, locks and spillways. Inventors' models and drawings relating to the early history of applied electricity—the Wallace dynamo and arc light, the Page motor, the reciprocating electric engine and certain other apparatus of Prof. Henry, and a model of the Morse telegraph register—are contributed by the Smithsonian Institution. New York State furnishes an operative model of the use of electricity on the Mohawk River at Yosts.

As in all "shows" of this special character, many exhibits, demonstrations and selling booths are found that have no direct connection with the main object of the show. One of the most interesting among the strictly electrical applications shown is an exhibit bearing on the problem of the food supply, viz., the stimulation of plant growth by electric radiations and electrified irrigation. A good-size model greenhouse is installed to demonstrate what may ultimately be done by electricity in the "forcing" of garden truck to obtain early fresh vegetables and in increasing the yield. This demonstration represents an agricultural art which is still in the experimental stage. An actual utilization of electricity in connection with farming is set forth in large photographs, including those displayed by the Reclamation Service, already mentioned. A considerable space is given over to electric incubators and their products, including an actual barnyard scene with several family groups of mother hens, ducks, and Guinea hens and their artificially hatched broods. Electric lighting naturally figures largely in the show, both in the illumination and decorations of the building and in the special exhibits of the progress that has been made in electric lighting, including progress in tungsten lamps. An improved form of the so-called "straight-line" filament lamps, giving an evenly distributed illumination for desks, deserves mention. The demonstrations of commercial work include electric "spot" welding, small power applications, the lead storage battery and the Edison storage battery shown with the laboratory machines used to test the endurance of the nickel-iron cell to mechanical shock, etc., the new Edison alternating current rectifier, instructive literature on reading the electric meter, motor driven inclined elevators for the handling of goods in warehouses and department stores and the like. Among household applications of more or less novelty and use are "general utility" motors and "power tables," improved types of vacuum cleaners, washing machines and other labor-saving appliances. Several of the electricity supply companies of Greater New York and vicinity display instructive charts, automatic stereopticon views and photographs showing the growth and utilization of their product, in line with the remarkable activity of the "new business departments" of the central station companies nowadays; and the Brooklyn Edison Company has a 100-foot panorama of the Brooklyn water-front, realistically illuminated, to set forth the desirable features of that borough as a location for manufacturing enterprises.

The electric vehicle exhibition comprises many makes of pleasure carriages, commercial cars and industrial trucks. Special provision is made for the "demonstration" of all kinds of cars, including a ten-lap track surrounding the third floor of the hall and realistically arranged to simulate the real outdoors. Instruction in driving electric carriages will be given to women visitors, utilizing special appliances to make the learning easy.

Sinhalese Iron of Ancient Origin

By Sir Robert Hadfield, F.R.S.

THERE being little definite evidence regarding ancient iron, the author describes some specimens from the buried cities of Ceylon. His paper supplements one by Dr. G Pearson, read to the Royal Society in 1795, on Indian steel of modern manufacture.

The specimens investigated, obtained from the Colombo Museum, through the kindness of the Governor General of Ceylon, Sir Henry McCallum, are (1) a steel chisel, fifth century A D.; (2) an ancient nail, probably of same place and date; (3) a bill-hook. This date has been verified by Dr. A. Willey, F.R.S.

Examination of the chisel showed:

C	Si	S	P	Mn	Fe	Specific Gravity
traces	0.12	0 003	0.28	nil	99.3%	7.60

Difference being slag and oxide

The Frémont shear test showed 16 tons per square inch elastic limit, 26 tons per square inch breaking load. The shock test showed 17 kilogrammes with 85 degrees bend before breaking The Brinell ball test showed hardness numbers 144 and 144 on opposite sides. The scleroscopic hardness was 35. The transverse section shows the specimen to be somewhat carbonized, with carbonized areas on two sides. The presence of Martensite and Hardenite suggests the important information that the chisel was quenched.

The analyses probably represent the only modern complete determination of the composition of authentic specimens of ancient iron The percentage of phosphorus, though high, does not greatly differ from modern bar iron. Sulphur is extxremely low, showing the employment of a very pure fuel. There is very little silicon, while manganese is entirely absent, which is somewhat remarkable since nearly all iron contains some manganese.

From microscopical examination and other tests it results that the specimens represent wrought iron rather than steel They somewhat resemble puddled iron, and seem to have been made from rather impure ore. The percentage of carbon is low, as is the case of other impurities with the exception of phosphorus Slag is present in considerable quantity in a lumpy, irregular form, indicating that the material was not submitted to the amount of forging undergone by modern wrought iron.

The author has also been able to obtain specimens from the actual Delhi Pillar. These have been analyzed, and it may be interesting to give the composition, which is as follows:

C	Si	S	P	Mn	Fe	Total
0.08	0.046	0.006	0.114	nil	99.72	99.966%

Specific Gravity 7.81%.

The iron percentage was determined and not taken by difference.

It will be noticed that this material is an excellent type of wrought iron, the sulphur percentage being particularly low, 0.006 per cent. This indicates that the fuel used in its manufacture and treatment must have been very pure, probably it was charcoal. The phosphorus percentage is 0 114 per cent. It will also be noticed that there is no manganese present, which is a somewhat special point, as wrought iron usually contains some manganese.

This is probably the first time that a complete analysis has been given of the material of which this pillar is composed.

Both the analyses now given represent material of almost similar composition This is somewhat remarkable in view of the fact that these specimens were taken from places widely apart The processes then prevailing of manufacturing this ancient iron were, however, evidently very similar in different parts of India.—Proceedings of the Royal Society, A, Vol. 86, 1912; also of the Iron and Steel Institute, May, 1912.

Landsman's Log Aboard the United States Destroyer "Patterson"—II.

By J. Bernard Walker

The present series of articles is a record of impressions gathered by the Editor, on a week's cruise aboard the destroyer "Patterson," during the summer maneuvers at the eastern entrance to Long Island Sound.

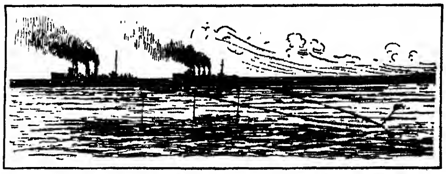
THERE is a sharp word of command from the bridge, followed by a crash, a reverberating rattle, and a prolonged shudder throughout the whole fore part of the ship, and we are at anchor for the night, or rather for the early part of it, within a mile of the clustered buildings which house the summer visitors to Block Island.

The day has been a characteristically busy one for the torpedo-boat destroyers. We were under way at five in the morning and have been ceaselessly engaged in a variety of maneuvers for the last twelve hours. It seems to me that we have put in a strenuous day's work; but a wireless has just been received from the Admiral, giving the programme for a series of night maneuvers, which will necessitate our getting under way at 10 P. M. for an all-night stretch of the most exciting, and certainly the most trying, of the duties which fall to this severely-worked branch of the naval service.

It is not of the night work, however, that I am now to write; I shall rather make some notes on the work of mine sweeping, which has formed the exercises of the day now drawing to its close.

The torpedo boat, or rather the destroyer, as it is called (torpedo boats are no longer built for our navy), has undergone a development in size, speed and power, and the enlargement of its field of operations, which is as great and probably greater than that of any type of warship. The earliest torpedo boats were such diminutive craft and of such limited speed, that their activities were confined chiefly to the sheltered bays and harbors of the coastline; and even in that restricted sphere their value was very problematical. The first boats built for the British Navy in the late seventies and early eighties were little craft sixty feet long, seven to eight feet in beam, and of a displacement of from fifteen to twenty tons. Their best speed was from sixteen to seventeen knots. In 1885 the displacement had increased to forty tons, and in 1890 to eighty-five tons, the speed ranging from eighteen to twenty-two knots. Many of us still remember the "Stiletto," built by Herreshoff at Bristol, Rhode Island, in 1886. We were very proud of the famous craft in those days; yet she was only eighty-eight and one half feet in length, with a displacement of thirty tons, and her best speed on trial was a trifle over eighteen knots. In 1890 we were building boats of 120 tons displacement. In 1900 the displacement had risen to 165 tons and the speed to twenty-six knots; and by the year 1904, at the time of the Russo-Japanese war, the displacement of the torpedo boat (or destroyer as she had come to be called) was between four and five hundred tons and the speed had risen to thirty knots.

Now this war afforded a very severe test of the all-round value of the destroyer. It struck the first vital blow and gave to the Japanese fleet an ascendency which was never lost throughout the war. The Japanese put their destroyers to new uses. They employed them largely as dispatch boats, and for scouting and other service which took them out upon the high seas and called for extended cruising. The destroyer assumed a new importance. Its sphere of operations was greatly enlarged, and the advantages of greater displacement and better sea-keeping qualities were immediately recognized. Since that war development has been rapid. To-day, scouting duties with the fleet have been largely handed over to these craft, which now perform much of the work formerly allotted to the unprotected cruiser. Within the next three or four years, we shall see destroyers of from one thousand to fifteen hundred tons displacement, of thirty-five knots speed, and provided with a fuel supply which will give a greatly extended radius of action in company with the battleship fleets.

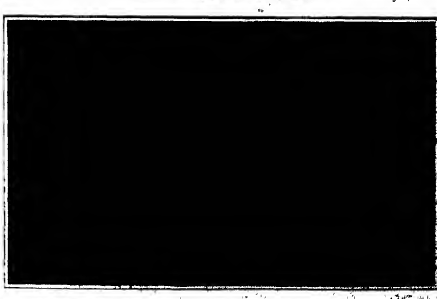


A length of chain, dragged by two destroyers through the mine field, clears a channel. The light draft of the destroyers enables them to pass clear of the mines.

Destroyers clearing mine field by "sweeping."

One of the "Patterson's" boats recovering a mine which has been broken adrift by the sweeping operations.

From the sailing cutters the mines are lowered into position by means of small cranes at bow and stern of the boats.



Lowering a platform with six mines from the deck of a battleship to a sailing cutter.

Our orders for the day were to proceed to a point off Watch Hill. There we would find a fleet of half-a-dozen battleships, surrounded by a mine field, which had been laid over night by the enemy, and through which, by the operation known as "sweeping," we were to open a channel for the escape of the fleet. Although the mines were supposed to have been planted by an enemy, as a matter of fact they had been laid down by the battleships themselves; and before proceeding to describe the sweeping operations as carried out by the destroyers, it would be well to explain the character of the mines and the method of planting a mine field.

The mine consists of a hollow metal sphere, loaded with one to two hundred pounds of high explosive; a cylinder loaded with ballast; and a connecting length of wire cable. The loaded cylinder is lowered to the bottom and serves as an anchor to hold the mine in place. The mine with its explosive is connected to the ground anchor by the cable, which is so adjustable that the mine will float at a predetermined depth—say from twelve to fifteen feet below the surface of the water, the cable paying out or taking up, as the tide rises and falls. The spherical mine with its charge of high explosive being buoyant, tautens the connecting cable and floats at the desired depth, which is so chosen that the mine will strike the submerged hull of a warship well below the surface of the water. The mines are laid in successive rows, which are so placed with regard to each other, that a ship which might pass through the first row will be certain to strike a mine of the second or third row.

Each battleship carries a complete outfit for mining operations, and the seamen are instructed how to load the mines, adjust the automatic firing mechanism, connect up the cables, and put everything in ship-shape condition for mine-planting. The large illustration shows the crew at work on the quarterdeck of a battleship, assembling the mines ready for planting.

The mine-laying is done by the ship's boats. Stout timber platforms are constructed on the deck of the battleship, and along opposite sides of this are placed three mines with their respective anchors suspended over the sides of the platform. The ship's boats are brought alongside and the platforms are lifted from the deck of the warship, and lowered down upon the gunwales of the boats, as shown in the accompanying illustration. When the boat has been towed to a designated position in the mine field, the anchors are lowered in succession by means of small cranes rigged at bow and stern of the boats, and the spherical mines are dropped over after them. Row after row is planted at suitable intervals, until the whole channel has been covered.

In yesterday's exercises the fleet made its way out of a harbor menaced by a group of submarines. To-day it was supposed to be forcing its way out of the same harbor through a mine field. Yesterday it was the duty of the destroyers to detect, and if possible sink, the submarines. To-day it was the duty of the destroyers to open up a wide channel through the mine field, either by removing the mines or by exploding them.

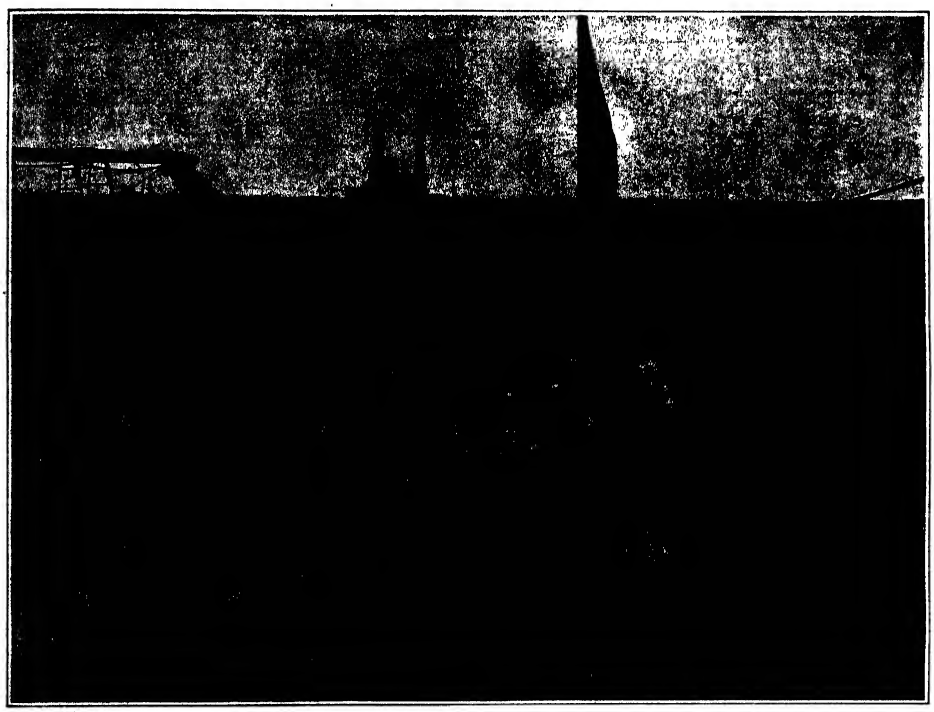
The first thing to be done was to lay out a course on which the channel was to be cleared. Accordingly, the "Patter-

... acting under wireless instructions from the Admiral of the beleaguered fleet, steamed on the outside of the mine field to a designated position, and then sent in six destroyers, which passed over the mine field (which they were able to do in safety, since the mines were fifteen feet below the water and the destroyers draw only eight or nine feet) to the fleet.

Two of the destroyers then took station a few hundred feet apart, and a length of chain cable was payed out from the stern of one to the stern of the other boat. The ends of the chain were made fast to two lengths of towing cable, and it was allowed to drop to the bottom. The two destroyers then steamed across the mine field in the direction of the "Patterson" at a speed of three or four knots, dragging the chain cable over the bottom. As the cable encountered the anchors of the mines it would slip up over them and catch the wire rope extending from the anchors to the buoyant mines above. Under the pull of the destroyers, these ropes would slide into the bight of the chain; and, if the mines were not theoretically set off by the shock, the anchors, the anchorage ropes and the mines themselves would be dragged along by the destroyers clear of the mine field. A little to one side of the course thus swept over by the first two boats, another chain was dragged, clearing another hundred feet or so, and then the third pair of destroyers dragged their chain across the mine field. As the destroyers reached the "Patterson" they bore off to port or starboard, dragging the captured mines clear of the channels. Finally, another pair of boats worked over a wide area through the center of the channel thus cleared, so as to make sure of removing any mines which might have escaped the first sweeping.

Theoretically, the channel was successfully cleared, and the fleet steamed out through the mine field without the loss or injury of a single ship. Let it not be supposed, however, that mine-laying or mine-sweeping will be the comparatively simple operation which we witnessed that morning. As a matter of fact, it is one of the most dangerous possible. In the first place, the mine fields which cover the approaches to a harbor are almost invariably protected by a battery of heavy rapid-firing guns on shore. Counter-mining or sweeping would have to be carried on under a heavy fire. Similarly, if the ship's boats attempted to plant a mine field in the approaches to a harbor, the work would in all probability have to be done under the fire of the enemy's scouts or destroyers.

But, dangerous as this work will inevitably be, the history of our navy has shown that the greater the perils of any given service, the greater is the enthusiasm of the officers and men to undertake it. Popularity of any naval service is gaged, not by its dangers, but by the magnitude of the results which can be achieved. The experience of the Russo-Japanese war showed how deadly are the torpedo and the submarine mine; and it is certain that the navy which is highly proficient in mining operations, whether for attack or defense, will have a strong physical and moral advantage over an enemy that is deficient in this kind of warfare.



Copyright 1914 by R. E. Muller

Mining operations in the Atlantic Fleet.

The crew of a battleship are here engaged in assembling the mines ready for planting

Lightning and Our Forests

BULLETIN 111 of the United States Forest Service is a contribution to an unexplored field of research which promises to stimulate new and fascinating inquiries. The author's aim in the work, as he has clearly outlined it in the introductory paragraph, has been to arrive at some definite conclusions regarding the relative frequency with which trees are struck by lightning, the conditions which tend to produce the greatest danger, and the relative susceptibility of different kinds of trees. With the advent of a scientific fire protection on the National forests naturally came a fuller inquiry into the causes of forest fires. The result has been the compilation of data from all parts of the United States relative to the frequency of forest fires from lightning. The data have been gathered chiefly on the National forests by nearly 3,000 forest officers. In addition to these field data extensive laboratory experiments were conducted with a view to determine the electric conductivity of our native woods.

It was no slight task to attempt to bring within the compass of less than 30 printed pages a review of the history of past investigations, a discussion of the theories and beliefs held by the layman, as well as an explanation of the results of the author's own data and experiments. It is, however, a most admirable endeavor and is executed as well as the nature of the subject probably permits. All who have made a study of lightning and are acquainted with the paucity of reliable printed matter dealing with the subject, are familiar with the difficulties that surround the decipherment of what records there are. The author's own figures are all based on reliable data and his conclusions will probably stand the test of much more extensive researches, which others may conduct later.

This bulletin, which can be had for the asking, should be in the hands of every forest officer in the country. The publication should not only be in his possession, but it should be read very carefully. There are very erroneous impressions in the minds of the layman to the effect that certain trees are more liable to be struck by lightning than others, and the general public should be familiar with the findings as set forth in this bulletin. The author's conclusions are as follows:

1. Trees are the objects most often struck by lightning because: (a) They are the most numerous of all objects; (b) as a part of the ground they extend upward and shorten the distance to a cloud; (c) their spreading branches in the air and spreading roots in the ground present the ideal form for conducting an electrical discharge to the earth.

2. Any kind of tree is likely to be struck by lightning.

3. The greatest number struck in any locality will be of the dominant species.

4. The likelihood of a tree being struck by lightning is increased: (a) If it is taller than surrounding trees; (b) if it is isolated; (c) if it is upon high ground; (d) if it is well (deeply) rooted; (e) if it is the best conductor at the moment of the flash; that is, if temporary conditions, such as being wet by rain, transform it for the time from a poor conductor to a good one.

5. Lightning may bring about a forest fire by igniting the tree itself or the humus at its base. Most forest fires caused by lightning probably start in the humus.

Aviation at the French Maneuvers

Military Use of the Aeroplane by the Leading Air Power

By Stanley Yale Beach

ALTHOUGH the chief use of the aeroplane as foreseen by the Wright brothers was that for military purposes, France was the first country to employ this modern machine in the maneuvers which take place every fall. In the maneuvers of Picardie in 1910 three or four aeroplanes were supplied by the manufacturers for the purpose of showing what could be done. Last year military aviation had become half way organized and there were a number of aeroplanes arranged in groups of three or four, but the commander in chief did not make much use of these and did not recognize all their possibilities. This year aviation has advanced by such leaps and bounds that there were nearly four score aeroplanes on the ground and these machines were all arranged in separate escadrilles, or groups consisting of from five to eight machines each. The generals in command were able to call upon the pilots of these aeroplanes to go out on scouting and message-carrying trips at a moment's notice, and so well did they accomplish this that there were no accidents throughout the entire maneuvers and the headquarters of each army was always posted as to the latest movements of the enemy. The arrangement of the armies in the maneuvers this year was as follows:

The Blue Army, located in Anjou and commanded by General Gallieni, included the 10th and 11th Corps and the 1st Division of Cavalry, while the Red Army, scattered along the upper Creuse and commanded by General Marion, included the 9th Corps, the 3rd Division of Infantry, and the Colonial and 7th Division of Cavalry. With the division of reserves the entire number of troops was about 120,000, the whole being under the direction of the commander in chief, General Joffre.

The two contending armies were each provided with four escadrilles of aeroplanes, an escadrille containing on an average six machines. The Blue Army force consisted of two escadrilles of Henri Farman two-seated biplanes, one of Blériot monoplanes, and one made up half of Blériot and half of Borel monoplanes. The Red Army, on the other hand, had one escadrille of Deperdussin two-seated monoplanes, one of Maurice Farman biplanes, and one of Henri Farman monoplanes, while the forth was a mixed escadrille of three-seaters, including two Deperdussin monoplanes, two Breguet biplanes and two Nieuport monoplanes. Each aeroplane was obliged to carry the necessary spare parts and each army had besides a complete equipment of motor workshops, etc., consisting of one motor truck for every two aeroplanes. One of our illustrations shows a portable repair shop, which consists of a large van containing a lathe, grinder, vise, and all the various tools and necessary equipment for repairing the engines and every part of the machines. When the repair automobile is moving along the road the sides fold up and make a closed van, but when it is put into use on the field the sides are dropped down, as shown in the illustration, and thus making ample work benches for the mechanics. For the transportation of aeroplanes when they do not fly from point to point, large two-wheeled vans are provided in which the aeroplanes are placed in a semi-dismounted condition and drawn from point to point by attaching the two-wheeled van to the rear of a motor truck.

The maneuvers of the West, as they were called this year, occupied two weeks from the 8th to the 21st of September. Operations began on September 11th when the two airships used in connection

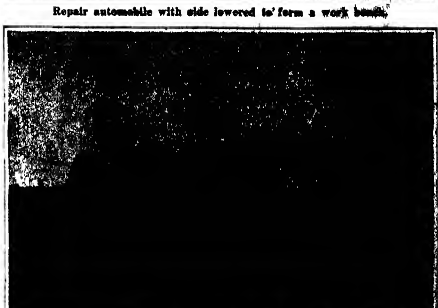
Courtesy of *L'Illustration*.

An escadrille of Farman biplanes.

Courtesy of *L'Illustration*.

A Blériot escadrille in front of a dirigible hangar.

Repair automobile with side lowered to form a work bench.



Sharpshooters trying to pick off a Blériot monoplane pilot.

with the aeroplanes, the "Dupuy de Lome" and the "Adjudant Reau," remained aloft and reconnoitered for a period of eight and six hours, respectively. The twenty-four aviators allotted to each army were actively engaged in flying and scouting throughout the day. Hundreds of flights were made and several thousand miles were covered by the forty-eight machines which were in use. The rules were that if an aeroplane landed in the enemy's country, it would have to be brought back to headquarters and remain neutralized for twenty-four hours. Among the lengthy flights made on the 18th were four of about 125 miles each, made by three lieutenants and one sergeant. During the first part of the maneuvers, which lasted three days, out of the forty-eight aeroplanes engaged, eleven were temporarily disabled, and four of these were captured by the enemy. Nevertheless, General Gallieni congratulated his aviators on the abundance and correctness of the information they gathered. He stated that he had made his decisions largely on this information, and that he had never found himself in a bad position from having done so.

As all the military pilots were skilled aviators and had had experience in flying, it is not to be wondered at that the reports they gave were wonderful in their accuracy and detail. The fact that each aviator generally has a companion to take note of the country below him and report on the movements of the troops, made it all the more possible to give accurate information. In one instance a well-known aviator landed beside Grand Duke Nicholas of Russia and gave him personally a report of his scouting flight. The Grand Duke was so enthused at receiving this information that he had the officer sign the report, and he sent it to Russia to show what is being accomplished by the French military aviators.

In addition to this gleaning of accurate information promptly by the scouts, such information was at the disposal of the Generals instantly by means of wireless telegraphy. The Farman biplane of escadrille No. 2 was fitted with a new wireless transmission set, the invention of M. Rouzet. This set consists of a small dynamo driven from the aeroplane motor by means of sprockets and a chain and absorbing not more than half a horsepower, and an antenna consisting of a wire about 130 feet in length—sufficient for transmitting messages a distance of 62 miles. The weight of the entire apparatus is but 88 pounds, and the space it occupies is 10 by 10 by 28 inches high. During a two-hour reconnoiter on September 10th, in which the inventor was at the key of the instrument in the aeroplane, messages were sent continuously during the flight and headquarters was kept in touch with all that was going on about the field. When the aeroplane was at a height of from 1,650 to 5,250 feet, the communication was perfect. Fog and clouds were often interposed between the aeroplane and the receiving station, but neither affected communication. This new system has the advantage that there is no interference with other stations and only the special portable receiving stations can catch the messages from the aeroplane. The apparatus is so simple that an ordinary sapper can, after about two months' training, be used for the purpose of sending messages.

After many more excellent flights had been made during the course of the same maneuvers, the latter were terminated by a grand review of the aeroplanes by M. Millerand, Minister of War. This took place on September [illegible]. M. [illegible]

(Continued on page [illegible].)

[illegible] Mast for Dirigible Balloons

THE picture herewith represents a device for mooring dirigibles safely in the open air, which for theoretical reasons has been repeatedly recommended in the columns of this paper, and which has been put to the practical test by the British Air Battalion with complete success during the summer of 1912. It consists of a mast of steel lattice work, made in three pieces. It is erected on a block of wood and held upright by four steel cables. Around its top swivels a large cone, made of wood, covered with canvas and upholstered on the inside. This cone is intended to fit like a cap over the front end of the envelope of the dirigible.

The device works as follows The air ship is landed near the mast. A "tassel" of ropes hanging out of the cone is pulled out, and the rope ends are strapped individually in a circle around the front end of the envelope. The dirigible is then taken nearer the mast, the cone is brought in line with it, and by pulling from the ground on a strong steel cable to which all the single ropes of the "tassel" are made fast, and which runs over a pulley drop in the apex of the cone the front end of the envelope is drawn firmly into the padded cone.

In an exhaustive trial during a very rainy and stormy night, it was proved that the airship thus moored and with the envelope kept stiff by a blower pumping air from the ground through sixty feet of four-inch hose into the ballonet, swings with the wind as freely as a weathervane while the cone prevents any collision with the mast, if the wind becomes very irregular.

Dirigible anchorage.

Woodpecker's store-house.

Pigeon scout photographic station

The Lookout Mountain Road

A REMARKABLE piece of road building has been done in the vicinity of Los Angeles, California on an automobile highway from Laurel Canyon to the summit of Lookout Mountain. It is just wide enough for one vehicle and has one route for the ascent and another for descending cars. It rivals the famous roads of Norway and the Alps in its multitudinous Y's, hairpins and sharp turns. The side of the steep mountain is actually terraced by this road and six levels are shown in the photograph one directly above the other. The popularity of this run is shown by the string of cars on a holiday. The grades are very easy and the road is perfectly safe. The roadbed is of decomposed granite, making a splendid surface. The road was built recently to lead to a summer hotel on the summit.

The one-way road up Lookout Mountain, California.

A Woodpecker's Storehouse

THE accompanying photograph shows in a realistic manner both the industrious and damaging habits of the energetic California woodpecker (*Melanerpes formicivorus bairdi*). It is a section of a telegraph pole that stood recently along one of the railroads near the Pacific Coast, which, as will be seen, has been fairly riddled and honeycombed on its four sides by thousands of holes pecked and bored out by the bird. Of course, these numerous cavities weakened and destroyed the usefulness of the pole, which had to be cut down and replaced by a new one. The damaged telegraph pole is the result of the wisdom and foresight of this smart little bird who is able to see far beyond the end of his bill. It was occasioned by the problem of food and a practical knowledge of the necessity of laying something by for a rainy day. When autumn leaves begin to fall and hints of frost are in the atmosphere the woodpecker puts in his spare moments hiding fat, juicy acorns in nice little cavities pecked out by himself in pine trees. If these are scarce in the particular region of his habitat a high telegraph pole is considered ideal for a safe storage plant.

Though practically hidden from outside interference, these food store-houses are not beyond the reach of certain pillaging members of the bird and animal world such as the jays magpies and squirrels. To be on the guard against these robbers the bird bores a deep cavity sufficient to take in his whole body and there he stations himself to guard against any approaching marauders and trespassers. In consequence there are numerous battles and the ordinarily well disposed and peaceful woodpecker among its kind becomes a vigorous fighter and all intruders are attacked and driven away in a hurry. During the spring and summer the food supply of the woodpecker consists of fruits berries and to a great extent of various insects. From its destruction of the young larva and many insect pests the bird is looked upon as of considerable economic value in the community.

Laundry car for the Russian army

Laundry machinery installed in the car.

Pigeon Scout Stations

EXPERIMENTS have been made in Germany in the use of pigeons for scouting purposes. The pigeons are provided with miniature cameras furnished with shutters that are released automatically. The birds are set free from such points that they are liable to fly over the enemy's fortifications. When they return home the photographs they have taken are developed and the chances are that some important disclosure will appear on the film. A field station for pigeon scouts is shown in the accompanying photograph. It consists of a vehicle on which is a small dark room and which also carries a pigeon cote. The latter is supported on a pair of lazy tongs so that it may be elevated to the position shown in the photograph by operating a pair of crank handles at the rear of the vehicle. When the pigeon flies into the cote the latter is lowered and the camera is removed from the pigeon after which the film is developed in a few minutes.

Laundry Car for the Imperial Russian Troops

A LAUNDRY car has recently been introduced on the Russian Government Railways for the use of the Imperial troops. It was built at the Hanover Wagon Works Hanover Linden Germany. The car has a width of 9 feet 10½ inches and a height outside at center from rail level of 13 feet 9 inches and is built according to the Russian standard 5-foot gage. The equipment includes steam boiler condensing tank feed pump injector steam engine cold and hot water tanks, soda cleansing medium washing machine draining box centrifugal driers mangle fans ventilator and disinfector together with ironing board with heaters at the finishing end the central portion being used for drying and storing the linen. Thus a complete laundry on wheels is provided which should do much toward improving sanitary conditions in the army.

A Wind Wagon for the Sahara

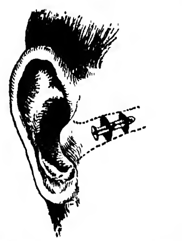
LIEUT LAFARGUE commanding the Sahara aviation center at Biskra has just made a report to the Algerian headquarters relating to some experiments with a new method of traction which may prove very useful in crossing the desert. The apparatus consists of a sled which is driven by a propeller and a 50 horse power aeroplane motor. The details of the apparatus are not given but it is said that it will carry three persons and can easily circulate upon the sand dunes at a speed of 20 miles an hour or even more. It is the invention of Capt Cros and was designed in the first place to convey aeroplanes in the desert across the sand dune region of Grand Erg which it was hitherto impossible to cross by any kind of vehicle and it may prove not only a valuable aid in aeroplane work but also come into use in general for transport in the desert regions. The first trials were made in July and will be followed by others in October. The officers propose to fit planes upon the sled so that it will act partly on the principle of the aeroplane.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Ear Protector for Gunners

IN the SCIENTIFIC AMERICAN of March 9th, 1912, we described an ear protector used by men on our battleships and by the United States Coast Artillery companies to prevent injury to the inner ear from excessive or injurious vibration due to concussion caused by the discharge of firearms. The inventor of that device has recently improved it considerably, as shown in the accompanying illustration. It will be recalled that the protector shown in our previous issue was in the form of an anchor with a bulb at the end



Position of the protector in the ear.

which fitted into the ear passage. The disadvantage of the device lay in the fact that it was not very comfortable in the ear, as it afforded poor ventilation and was too apt to be misplaced accidentally. For this reason the present device was invented. It consists of a tube of celluloid bearing two thin washers or diaphragms of rubber or leather. The bore through the celluloid tube has ports between the washers and terminates in a passage running at right angles to the bore at the inner end of the device. In this way there

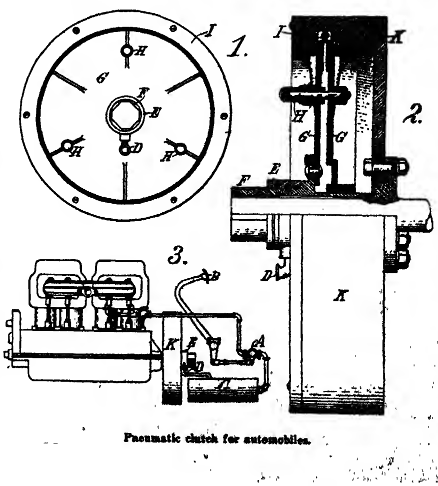
Enlarged view of the protector.

is thorough ventilation of the ear, so that the device may be worn with comfort. It must be understood that the device is not a plug, but in a true sense of the word a protector. The small bore in the celluloid piece will not carry the heavy vibration due to the concussion movement of the air, but will admit ordinary sound waves, so that it is possible to converse and hear conversation very plainly with the protector in the ear. The passage through the protector is so disposed as to prevent the concentration of the sound waves by the pinna of the ear. It will not only prevent gun deafness, and "ringing ears," but will shut out wind, dust or water from the ear canal.

Pneumatic Clutch for Automobiles

AN inventor, living at Los Angeles, Cal., recently devised a pneumatic clutch for aeroplane engines. The clutch was experimentally fitted to an automobile, and on a test run to Santiago it gave such excellent results that it was decided to manufacture this form of clutch for automobiles. On this test run an air pressure of less than one pound was employed in the clutch, and its ease of contact and quick release were very satisfactory.

The operation of the device was as follows: By means of small ports tapped into the cylinder at the bottom of the stroke a pressure of about two pounds could easily be obtained under lowest throttle. This exhaust gas was led through a small pipe to a check valve and then to a three-way valve *A*, Fig. 3, operated in this instance by a foot pedal *B*, and connected in the conventional manner to the emergency brake. The three-way valve transmitted the pressure to the clutch on retracting the pedal and released the clutch when the pedal was pushed down. The pipe line leading from the valve *A* entered a small tank *C*, which acted as a reservoir to take up the pulsations from the cylinder, thence the pipe line continued to the clutch, entering it at the point *D*. Fig. 2 shows the clutch partly broken away to reveal the interior details. The exhaust gases under pressure were led to a ring *E*, which was stationary upon the clutch sleeve *F*, and passing through a channel in this ring the gas was admitted through ports in the sleeve to a space between the two movable cone-shaped members *G*. These cone-shaped members were mounted back to back and coupled together with pins *H* which, owing to their sliding engagement with one of the members, allowed the members to move apart. The members *G* were also connected at their peripheries like a bellows by means of two leather bands *I*, as shown to best advantage in Fig. 1. The cone faces of the members *G* were coated with granulated compressed cork, so as to provide better gripping surfaces. The air pressure introduced between the members *G* caused them to spread apart, and engage the outer member *K* of the clutch. The pressure of a fraction of an ounce would bring the friction surfaces into contact, after which a steadily increasing pressure would develop until the car was started. The transmission of from one to one hundred horse-power as the pressure increased was readily accomplished. The cam lever was connected to the gear-change shaft, and owing to the easy engagement and quick release of the gears it could easily be shifted when not under strain without attention to the foot pedal.



Pneumatic clutch for automobiles.

The Diesel Patent

By Mayner H. Gordon, United States Patent Office

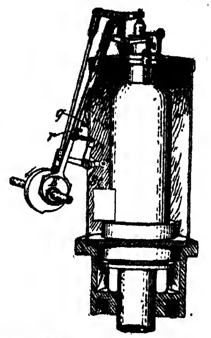
THE twentieth century may well be called the oil age. If one but stands for a minute upon a street corner of any of our large cities, and notices the number of automobiles passing, and considers the increasing number of vehicles of the air, or goes to the river bank and watches the countless motor boats rushing to and fro, he realizes how dependent humanity is upon petroleum. And when we stop to consider for a minute how very young the art of self-propulsion is and what rapid strides it has made in the last few years, we cannot help but feel that the coming years will bring before the world a period which should be designated in the life of our planet as the oil age.

So after all, we should give due credit to those pioneers in the oil fields of Ohio and Pennsylvania who have done so much to promote the science of self-propulsion. For without petroleum we would not have the automobile, the aeroplane, or the motor boat; at least it is safe to say that we would not have reached a point so far in their development. For, as with other inventions, the aeroplane, the automobile, and the motor boat have been both bettered and cheapened by the advent of the internal-combustion motor.

We have now reached the time in the development of the internal-combustion engine at which we appear to be about to take a stride forward. Within the last few years a new type of motor has been pushing its way to the front. This is the Diesel engine, an engine whose wonderful popularity is due chiefly to three points. The first of these is the fact that it runs on crude oil or petroleum at an efficiency of 0.38 pound of fuel per brake horse-power an hour. The second is that it may be very reliably designed in large units, engines of this power having been constructed as high as 12,000 horse-power. The third point lies in its extreme simplicity.

Public interest appears to be all the more awakening in this wonderful engine, owing to the fact that the basic patent expired upon July 16th, 1912. The purpose of this article is an attempt to show something of what this patent contains, and to make clear to the public just what will become of their property upon its expiration.

The Diesel engine is protected by three patents granted to Dr. Rudolph Diesel as follows: 1. No. 542,846. Method of an apparatus for converting heat into work, patented July 16th, 1895. 2. No. 608,845. The internal-combustion engine, patented August 9th, 1898, reissued April 2d, 1901. 3. No. 673,160. The method of igniting and regulating combustion for



Speed regulating mechanism of the original Diesel engine.

internal-combustion engines, patented April 30th, 1901.

The Diesel process in brief is as follows: Air is drawn into a cylinder by the downward stroke of a piston; the piston then moves upward, compressing the air into a very small clearance space at the top of the cylinder. The high compression used increases the temperature of the air to a point above the igniting point of the fuel used. Simultaneously with the downward stroke of the piston, the fuel is admitted in either solid or liquid form into the cylinder for a portion of the stroke. The fuel at once ignites, and combustion taking place, energy is developed in the resulting gas, which continues to expand during the remainder of the working stroke. The exhaust stroke then takes place and the cycle is repeated. This process in brief is the process set forth by the patent issued to Diesel July 16th, 1895. It is interesting to note that either solid or liquid fuel may be used. For solid fuel an arrangement is made of a rotating valve containing a pocket, as shown and described in the application; for liquid fuel the use of an ordinary spray nozzle is advocated. It is also stated in the application that liquid fuels may be profusely converted into vapor and introduced in this form. Perhaps the two most important points set forth in this application is that the introduction of fuel takes place gradually in order that the pressure will not rise too abruptly; and also that preparatory compression of the air in a separate cylinder, before admission into the main cylinder, may be used together with an injection of water into the compressor if necessary, in order to keep the temperature of the preparatory moderately low. It is further suggested in the application that the expansion or working stroke may be carried to a point at which the temperature of the exhaust gases are brought by expansion to a point below that of the atmosphere, thereby producing a gaseous medium which could be used for refrigerative purposes.

The speed-regulating mechanism of the-

... original engine is shown in the accompanying engraving. The eccentric *E* moves the rod carrying the steel side piece *g*, fastened thereto, up and down and in an oviform curve. The fuel admission valve *a* is opened by the rod which carries a small steel block *r*. This steel block *r* engages for a certain portion of the circular travel with a steel piece *g*. The length of the engaged travel is determined by the position of *r*, which is regulated by the linkage mechanism *St*, which is connected with the governor. This means, therefore, determines the cut-off point for the fuel. The use of compressed air for starting the engine is suggested where supplementary air compression is used; the air for this purpose being stored in a reservoir. The use of a separate cylinder for the expansion of the exhaust products is suggested. The claims of the patent are as follows:

"1. The herein described process for converting the heat energy of fuel into work, consisting in first compressing air, or a mixture of air and neutral gas or vapor, to a degree producing a temperature above the igniting point of the fuel to be consumed, then gradually introducing the fuel for combustion into the compressed air while expanding against a resistance sufficiently to prevent an essential increase of temperature and pressure, then discontinuing the supply of fuel and further expanding without transfer of heat.

"2. In an internal-combustion engine, the combination with the cylinder and piston, of a valved suction inlet for air or a mixture of air and neutral gas, a valved fuel feed constructed to gradually discharge the fuel into the cylinder, and means in operative connection with the feed valve for opening the same at the commencement of the working stroke of the piston and for closing the same at a predetermined part of the stroke, substantially as described.

"3. In an internal-combustion engine of the character specified, the combination of a combustion cylinder provided with means for gradually introducing fuel therein up to the point of cut-off, a compressor for air, a reservoir connected with the latter and with the cylinder, and an expansion chamber for the exhaust gases, substantially as described."

The patent of August 9th, 1898, will apparently still give protection to the inventor in a large majority of cases. This will be seen from claims 7 and 9 of this patent, which are as follows:

"7. In an internal-combustion engine, the combination with a cylinder and a piston constructed to compress air to a degree producing a temperature above the igniting-point of the fuel, of a fuel-feed, and a valve mechanism adapted to open the fuel-feed somewhat in advance of the end of the compression stroke of the piston and to keep it open during part of the working stroke, substantially as and for the purpose specified.

"9. In an internal-combustion engine, the combination of a cylinder and piston constructed and arranged to compress air to a degree producing a temperature above the igniting-point of the fuel, a distributing-valve for fuel, and a cut-off for varying the time and duration of the supply of fuel by said valve, substantially as described."

It will be noted that the two main points set forth in these claims over the original patent are: first, an admission of fuel before the completion of the compression stroke, and secondly, a variation in the time of fuel admission as well as the duration of fuel admission. The other points of novelty occurring in this second patent are: the use of a burner or burners similar to the ordinary Bunsen burner for the introduction of fuel into the combustion chamber, and an air supply pipe from the air supply pipe of the cylinder in communication with the fuel supply.

The reissue No. 11,960 of April 2d, 1901, sets forth in addition to the points given above, the idea of a valve mechanism consisting of a double set of cams which may be shifted so as to allow the engine to run on either the two-stroke cycle or the four-stroke cycle. Claim 10 of the reissue, which reads as follows, shows how broadly this device is covered:

"10. In an internal-combustion engine, the combination with the cylinder provided with fuel and air valve mechanism for operating same on a four-stroke cycle, and with means for supplying compressed air thereto, of valve mechanism controlling such compressed-air supply and means for operating said valve mechanism to enable the cylinder to work with compressed air on a two-stroke cycle."

The last patent of the series, that of April 30th, 1901, while not as important as the above mentioned patent, is interesting, in that it provides a novel arrangement of ignition. Claim 1 of this patent appears to be practically self-explanatory. The claim reads as follows:

"1. The method of regulating combustion in internal-combustion engines which consists in producing a mixture of air or oxygen and a combustible, compressing the mixture to a temperature lower than the igniting-point of the combustible, and introducing under excess of pressure into the mixture a secondary combustible, the igniting-point of which is equal to or below the temperature due to the compression, substantially as described."

In view of the foregoing it will be noted that anyone constructing an engine of this type could use the Diesel principle only provided he employed a fuel admission which began on an upper dead center. The cut-off could of course be made variable. The most important point in this limitation arises from the fact that the feature of not being able to admit fuel before the piston has reached the top of the compression stroke, limits public use exclusively to a slow running engine. It is absolutely necessary to obtain an advanced fuel admission in a high speed Diesel engine, just as it is necessary to use an advanced or early spark in the Otto cycle.

It will be noted in summation, that the Diesel engine will after all only become public property to a somewhat limited degree. As in other cases, however, the very limitation set upon that which the public receives may perhaps arouse more stimulus than it otherwise would in the mind of the inventor and thereby, after all, work for the greater benefit and furtherance of the internal-combustion engine in the development of the oil age.

Early Attempts to Protect Trade-marks

By William L. Symons of the United States Patent Office

THE first Federal law providing for the registration of trade-marks in the United States Patent Office was passed, as is well known, in 1870. Long prior to that date, however, attempts were made to protect trade-marks by depositing them in the Patent Office.

The earliest effort was made under the design patent act of 1842. This law provided in part that anyone who had invented

". . . . any new and useful pattern, or print or picture, to be either worked into or worked on, or printed or painted or cast, or otherwise fixed on any article of manufacture"

might obtain a patent therefor. Under this provision of the act it was thought that a trade-mark could be patented, and thus an exclusive right to it be secured. The Patent Office agreed with this view, for it soon began to issue patents for "designs for trade-marks." These patented trade-marks were applied, as stated in the application, to such goods as commonly bear trade-marks to-day, and consisted usually of the entire label placed on the goods. Upton, in his "Law of Trade-marks," published in 1860, which was the first text on this subject written in the United States, condemned this practice of granting such patents, and very clearly showed that it was not the purpose of the design act to protect the mere name or ornamental device by which certain articles of manufacture were known. His conclusion was:

"The policy of continuing such an unwarrantable construction of the law is, to say the least, very questionable."

His view of the law did not carry conviction, and the practice was continued until 1870, when some two hundred of these patents for trade-marks had been issued. Commissioner Fisher in that year stopped the practice, pointing out that the trade-mark law which had just been passed afforded ample protection to trade-marks, and that it had only been by a forced construction of the provisions of the design law that trade-marks had been included within it.

In 1869, however, jurisdiction was regularly conferred upon the Patent Office to accept the deposit of trade-marks by the citizens of Russia. The convention between that country and the United States proclaimed at that time prohibited the counterfeiting of the trade-marks of the citizens of the respective countries, provided for an action for damages in the courts of these countries, resulting from wrongful use, and required the marks of Russian subjects to be deposited in the United States Patent Office and of citizens of the United States to be deposited in the Department of Manufacture and Inland Commerce at St. Petersburg. Similar treaties were concluded with France and Belgium in 1869 by which citizens of those countries were enabled to deposit their trade-marks in our Patent Office.

Under these treaties marks were also deposited in our Patent Office by citizens of the United States. This practice was disapproved by the Commissioner of Patents in a ruling made in December, 1872, in which he held that these treaties and conventions did not confer authority for our Patent Office to accept the deposit of marks by our own people.

The desire of our citizens, therefore, to enter their trade-marks with the central government appears to have been strong at an early day, when a design patent in one instance and a convention to enable foreigners to deposit their trade-marks here in another were seized upon as authority for filing trade-marks in the United States Patent Office.

Legal Notes

Sunday and Amendments.—In *ex parte* Miller Commissioner Moore has decided that where the year within which action could be taken expires on Sunday, in order to save the case from abandonment, amendment should be filed on the preceding day.

A Point in Interference Proceedings.—In Seacombe v. Burks, Assistant Commissioner Billings has held that the question of a party's right to make claims corresponding to the issue of an interference does not depend upon whether an amendment is subsequently made. The sole question to be considered is whether the specification and drawing of the application are sufficient to justify the allowance of the claims in question.

The Davey Patent Sustained.—In Davey v. Cutter, 197 Fed. Rep., 178, the Davey patent, No. 890,968, for a process of treating and dressing a bruise or wound in a trunk or branch of a live tree was held valid and infringed. In the patented process a cavity is formed in the tree by removing all decayed, unsound and foreign matter, and the walls of the cavity are then coated with molten tar and before the tar hardens the cavity is filled with cementitious material which will adhere to the tar.

A Suit Thirty-six Years Old.—A suit is now before the Supreme Court and will probably be heard in October, which was begun in or about May 17th, 1876, in the Circuit Court of the United States for the Southern District of New York. The suit involved title to a number of Edison patents and the parties to the original bill were George Harrington, described as of Washington, D. C., and Thomas A. Edison, plaintiffs, and the Atlantic & Pacific Telegraph Company and Jay Gould, defendants. Testimony was taken in New York and London during 1879 and 1880, and in 1895 Thomas A. Edison, as surviving plaintiff, filed a petition in the case asking for a decree of revivor as against the executor and trustees of Jay Gould. Following the answer by the executor and trustees considerable testimony was taken and the case was heard. After various proceedings, appeals have been filed to the Supreme Court and the hearing soon to be had will be upon motions asking the dismissal of the appeals on the ground that the Court is without jurisdiction to pass upon questions sought to be raised. The prominence of the parties and the length of time consumed in the litigation give it a special interest.

Notes for Inventors

Ship-coaling Apparatus.—The apparatus shown in the patent to Michael S. Iverson of New York city shows a conveyor which is pivotally suspended at one end below a ship's deck so the conveyer can swing horizontally under the deck, a traveler supporting the swinging end of the conveyer so it can be adjusted under the deck and means being provided for adjusting the track for said carriage. The patent is No. 1,038,588.

A Conveyer with a Side Guard.—The gravity conveyer patented by John William Anderson, Jr., of Woodland, Ill., No. 1,038,514, has a bed consisting of a number of rollers side by side. Some, but not all, of the rollers are provided with means for preventing the lateral movement of the article conveyed, such means being shown as flanges on the ends of the alternate rollers and projecting across the space between the flanged rollers and the adjacent ones.

How About a Box Spring Improvement?—If you have ever slept on a good box spring you know what luxury is. The writer's experience, however, has shown that the box spring does not endure. He has been unable to find a reputable maker who would guarantee such a spring for any length of time. Ordinary bed springs last for years. The problem of a durable box spring should be solved by some one familiar with the subject.

Preserving Cotton Bolls.—Walter W. Gayle, of Montgomery, Ala., has patented, No. 1,038,562, an unopened cotton boll incased in a coating such as paraffin, impervious to air and moisture so as to preserve the boll in its unopened state, so that the boll can be harvested green or unopened and allowed to open subsequently out of the field. When so treated the boll is not subjected to deteriorating weather conditions nor to the collection of dirt, dry leaves and other foreign matters.

A Toy Eye Mask.—Herman Gruenberger of New York city, in a patent, No. 1,037,473, shows a toy in the form of a mask consisting of a cup-shaped body of yielding material which can be sustained by itself between the brow and the cheek over the eye and has a central opening through which the pupil of the natural eye is exposed, the mask, when one is applied to each eye, changing the appearance of the wearer to a remarkable extent.

Freak Amusement Automobile.—What is called a bucking automobile is covered in a patent, No. 1,039,035, to Charles E. Desenfants, of Chicago, as assignor of Edward W. Desenfants, and has front and rear axles with wheels on the ends of the axles and having their peripheries disposed eccentric to the axis of rotation, with the wheels on the front axles revoluble independently with respect to each other, so that as the car moves over the ground it will be given an eccentric motion.

A Novel Photographing Method.—Fletcher W. Battershall of Albany, N. Y., has patented, No. 1,037,192, a method of making photographs, in the practice of which a strip of film and means to separate the convolutions of the film but to exclude light are rolled together upon a spool and the film is exposed, and then with its separating means is rewound in a camera after which the roll is removed from the camera and developed in actinic light before unwinding it after it leaves the camera.

A Continuous Powder Packer.—Tadeus Paraskovich of Vienna, Austria-Hungary, has secured a patent, No. 1,037,974, for an apparatus by which medicinal and other powders may be packed. The apparatus includes a suitable guide plate on which a continuous strip of paper is fed or advanced, a suitable quantity of powder is deposited on the strip at intervals, the free end of the strip is bent upon the powder, and after the strip has been severed to separate the powder-carrying part from the body of the strip, the side and end edges of the severed and folded paper are perforated to secure the edges together and form a closed package.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

WIRE FASTENER FOR METALLIC FENCE POSTS.—H. L. HAESLEY, 604 Lonsdale Bldg., Duluth, Minn. This invention has for its purpose the provision of a simple and highly efficient wire fastener for metallic fence posts whereby wire may be conveniently secured to the posts by means of staples driven into the posts, and so firmly that the accumulation of sag is prevented at any particular point.

REGULATOR FOR CHICKEN INCUBATORS.—G. H. LEE, 1115 Harney St., Omaha, Neb. This inventor provides means whereby the percentage of moisture is varied proportionate to the variation of heat within the incubating chamber; and provides for changing the relative radius of alternation of dry heat and moisture in the said chamber.

STALK PULLER.—C. R. SMITH, Perris, Cal. The invention provides improvements that relate mainly to the gripping jaws for seising stalks, the links carrying these jaws and formed into chains, the means for guiding, supporting and adjusting these chains, and mechanism for preventing the entrance of stalks, dirt, or other undesirable material into the spaces between the links of the same chain.

Of General Interest.

BRUSH BACK BLANK.—F. ZIELINSKI, care of S. Sokal, 14 Southampton Bldg., 55 Chancery Lane, London, England. The subject of this invention is an improved method of fixing bristles in stocks, more especially stocks made of cast or stamped aluminium, which has the advantage over the method at present in use that the bundles or tufts of bristles need not be glued, sewn, pressed or jammed into sockets or other holders.

NON-REFILLABLE BOTTLE STOPPER.—E. MAYOLINI DE VALDES, 131 E. 82d St., Manhattan, N. Y., N. Y. This improvement has for an object the provision of improved means arranged in a removable tube which will act as a stopper for normally closing the bottle, but permitting the free flowing of liquid therefrom, and resisting any refilling of the bottle.

STOPPER FOR BOTTLES.—W. J. WARNER, 217 E. 81st St., Manhattan, N. Y., N. Y., and A. FEILER, New York, N. Y. This invention provides a valve construction designed to resist refilling of the bottle and causing measured quantities to be dispensed, this construction being associated with a plug device to permit fluid to freely pass, but to resist the passage of any mechanical instrument.

HOLDER FOR A PAPER OF PINS.—G. GIUGLIANO, 520 Symes St., West Hoboken, N. J. This inventor provides a holder for use in holding a paper of pins and arranged to display a single row of pins at a time and in such a manner that the individual pins of the displayed row of pins can be readily removed by the user whenever desire.

PHOTO-EXPOSURE METER.—S. PRATT, 35 Highland Ave., Oakland, Cal. This invention exposes successively any number of light screens between the object and the eye, until the proper degree of obscuring is obtained, the interposition of these screens being in synchronism with the movement of a pointer, running along a pre-calculated scale, the times of exposure being readily read off on this scale for different degrees of illumination of the object to be photographed, and for different apertures.

Hardware and Tools.

FASTENING DEVICE.—M. S. FULLER, care of A. L. Kellogg, Oneonta, N. Y. The body of this device has a slot formed in one extremity thereof and having a guiding projection formed adjacent the slot, so that the end of the cord to be fastened can first be passed around the projection and then back into the slot at the extremity of the fastening device, to have a wedging engagement therewith.

MITERING DEVICE.—F. N. RUSSELL and E. CLARK, 6000 Madison Ave., Chicago, Ill. This invention is a mitering device, and comprises a plurality of saw guides, together with improved means for adjusting the said guides according to the requirements of actual practice; and means for holding said saw guides in any adjusted position.

CUTTING DEVICE.—R. W. JOLLY, 264 W. 127th St., Manhattan, N. Y., N. Y. An object here is to utilize a blade similar to the common safety-razor blade, with means for normally protecting the sharpened edge thereof, adapted to be slipped to one side to expose a portion of the blade, whereby this portion may be used as a sharpener, eraser, or the like.

GUIDE FOR KEYHOLES.—L. B. HOWARD, P. O. Box 894, Los Angeles, Cal. This invention pertains to a device to be used on an escutcheon, lock-plate, or the like, and act as a guide for the key in entering the keyhole. An object is to provide a concavely-faced member surrounding the keyhole, which will serve as an inclined guide, acting to direct the key, from any direction, to the keyhole opening.

HOSE COUPLING.—C. [illegible] Ave., N. E., Cleveland, [illegible]

coupling is especially adapted for connecting the supply pipe to the tube in such machines as riveting hammers, drills, reamers, clippers and other machines utilizing compressed air as a motive fluid, wherein means is provided for making a connection without the necessity of tools and without requiring skilled labor, which will obviate the danger of blow-out and the like.

Heating and Lighting.

HEATING AND VENTILATING APPARATUS.—C. W. Edgar, 351 So. Ave., 66, Los Angeles, Cal. An object of the present invention is to provide a device having the form and appearance of an ordinary grate which may be used for heating air which is subsequently discharged into the room containing the grate, or which may be supplied to other rooms for heating them.

ACETYLENE LAMP.—J. M. Higgins, Caseyville, Ill. The inventor provides a lamp which may be easily taken apart to permit of cleaning or repairing, which will be capable of a very nice adjustment, and which will permit of an economical use of carbid, while affording a high degree of illuminating power.

Household Utilities.

SCREEN-WIRE CLOTH.—H. F. Jackson, 619 E. New York St., Indianapolis, Ind. This invention provides a cloth for use on door and window screens or to cover openings of buildings to keep out flies, mosquitoes and other insects, the cloth being reinforced in process of manufacture to render it exceedingly strong and durable without duly increasing the weight, and provides means for fastening the marginal edge of the cloth to the screen frame.

CLOTHES LINE SUPPORT.—M. Ruth, 89 Wegman Place, Jersey City, N. J. This invention comprises a compact attachment that can be easily mounted upon the side of a house adjacent a window thereof, and by means of which the clothes line can be readily and conveniently operated to enable the wash to be hung out to be dried and taken in after drying.

Machines and Mechanical Devices.

PHOTOGRAPHIC PRINTING MACHINE.—R. R. Loving, Center, Shelby Co., Tex. This machine is arranged to permit of accurately placing the negative (glass plate or film) in fixed position to print from, and to allow accurate positioning of the printing paper and bringing the same in printing contact with the negative.

WHEEL-RIM EQUALIZING AND TRUING MACHINE.—G. A. Ensign, care of Defiance Machine Works, Defiance, Ohio. This invention relates to woodworking machines, and provides a machine more especially designed for reducing half rims or fellies to circular shape and accurately cutting off the ends of the half rims or fellies to produce half rims or fellies of true semicircular shape, thus eliminating subsequent sawing of the joint when placing the rims on the spokes.

PORTABLE WELL BORING AND DRILLING MACHINE.—H. H. Haight, 935 W. 3d St., Waterloo, Iowa. This inventor provides an operating platform for a machine portable and operable upon its carrying wheels; provides a mechanism mounted upon a rotary platform, whose rotation is concentric with the center of operation of the well; provides an operating mechanism driven from a stationary member with which the operating mechanism is operatively connected; provides means wherein the speed of the hoisting drum is variable; provides a balancing fly wheel connected to the driving shaft by a dragging connection to relieve shock of sudden engagement between shaft and wheel, and to permit rapid initial acceleration of speed on the driving shaft.

DEVELOPING APPARATUS.—S. Pratt, 85 Highland Ave., Oakland, Cal. This apparatus develops and washes sensitized films in such a manner that they will at no time be exposed to the light. An object of the invention is to supply the developing apparatus with adjustments whereby it may be adapted to accommodate films of different sizes.

CLUTCH.—H. B. Savage, Cedar St. and Scioto Ave., Spokane, Wash. This improvement is in clutches in which an expansible ring is arranged within a cylindrical rim and adapted when expanded to firmly engage and lock with the same by friction. It is common to fasten such expansible rings in a way that the ring does not take a friction hold on the rim at all points. Mr. Savage overcomes this objection by providing means by which the ring engages the rim equally at all points.

OIL FEEDING DEVICE.—C. F. Hoover, 324 Chemical Block, Spokane, Wash. An object here is to provide a device in which the feeding of the oil is accomplished by pneumatic means. A further purpose of the invention is to provide a device by means of which the flow of oil may be regulated to any degree, within limits.

STEAM TRAP.—J. D. [illegible], Union City, Pa. In this trap the valve stem has free movement in a tube [illegible] with the valve stem, and to which a float is secured, the tube engaging a lever at the top of the trap, which operates through a [illegible] the lower lever engaging the member [illegible] to the valve stem to [illegible] the valve. [illegible]

FEED MECHANISM OF TURNING MILLS, LATHES, OR LIKE MACHINES.—A. E. BENNETT and H. THOMSON, care of Marks & Clerk, Coventry, England. This invention is primarily intended for use in turning machines, and is particularly adapted to suit what are now known as boring and turning mills, which are of the lathe type placed in a vertical direction, but may also be adapted to an ordinary lathe or similar machine having two directions of feed, the one at or about right angles to the other.

WHEEL BORING AND FACING MACHINE.—G. A. ENSIGN, care of Defiance Machine Works, Defiance, Ohio. This invention relates to wood-working machines and its object is to provide a new and improved machine more especially designed for boring and facing automobile wheels and similar wheels in such a manner that the boring and facing is absolutely true relative to the wheel rim, thus insuring the formation of a true wheel.

Railways and Their Accessories.

RAIL.—H COLLINS, Fairlawn, Newport, R. I. The invention provides a rail arranged to permit convenient removal of a worn out rail head and its replacing by a new one without disturbing the position of the remainder of the rail on the ties and without requiring tearing up of all the pavement flanking the rail, thus saving considerable expense in rails and time and labor in replacing worn out heads by new ones.

Pertaining to Recreation.

TOY.—P. B. TYLER, Butterfield, Minn. This invention provides a toy controlled to vary the path of travel thereof, the variation being a matter of skill, whereby the article is aimed at a target; and provides for determining the path of an automobile toy to cause the same to impinge upon, or glide with, articles disposed in the path thereof.

MEANS FOR INDICATING THE STRIKING FORCE OF GOLF CLUBS OR SIMILAR INSTRUMENTS.—S. O. H. COLLINS and H. V. PEARCE, care of Marks & Clerk, London, England. The object of this invention is to produce an indicating device by which an indication may be obtained not only of the force of the blow, but also of its approximate directness or the point of contact of the ball upon the striking face of the club.

Pertaining to Vehicles.

BOOT HOLDER.—W. D. GILBERT, care of A. C. Haughton, 120 W. Main St., Johnstown, N. Y. The object here is to provide an inexpensive device for holding a boot in place over a puncture or the like in a pneumatic tire, which will hold the boot firmly and tightly throughout its length, and which may be easily applied and detached.

HORSE HITCHING DEVICE.—G. K. F. JACK, The Rockland, Tremont, Denver. This invention provides a device for a horse, or horses, operable by the vehicle when pulled in a forward direction and arranged to release the pulling strain when the vehicle is moved rearward; provides locking means for the wheels of a vehicle; and provides a harness attachment whereby the wheel of the vehicle may be limited in its action to exert restraint upon the driving reins of the team attached to the vehicle.

BUGGY OR WAGON GREASER.—W. T. MADDOX, Alexandria, La. The invention has for its object the provision of a simple, inexpensive, easily operated device consisting of but few parts, capable of being stored in compact form, and wherein a variety of adjustments is possible.

Designs.

DESIGN FOR A COMBINED RAZOR STROP AND MIRROR.—S. RIEGER, 38 Varet St., Brooklyn, N. Y. This design is mainly of the usual shape, but the ring end and the handle end of the strop comprise original ornamental forms, the former end square, the latter end round and both holding mirrors

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Aviation at the French Maneuvers

(Concluded from page [illegible].)

and visited the field at Villacoublay at 6:30 A. M., and was piloted around the field by Colonel Hirschauer, permanent inspector of military aeronautics. M. Millerand reviewed ten regular escadrilles and five reserve escadrilles, containing in all seventy-two aeroplanes. The aeroplanes were all lined up on one side of this splendid field and presented a wonderful spectacle. After M. Millerand had completed his review and made a congratulatory speech, the aeroplanes were started in groups of from a half-dozen to a score at one time. They presented an imposing spectacle as whole flocks of these mechanical birds arose and flew home across country at high speed.

Commenting upon the results obtained at the French maneuvers, and, in fact, those obtained by all the maneuvers held by the various powers recently, including England, army men are of the consensus of opinion that the aeroplane has but one use, namely, its use in reconnoitering work as an aid to the cavalry. The idea that aeroplanes can be used for the purpose of fighting in the air, seems to be generally denied. According to a memorandum issued by the British War Office, the work of cavalry will undoubtedly be greatly aided by a well-trained aeronautical service, but except to a certain extent in long distance reconnoitering, air craft cannot in any way replace cavalry. The three uses of cavalry are given as (1) *gaining information*, (2) *affording protection*, (3) action on the battlefield. It is only to the first of these uses that the aeroplane can properly be put. The three kinds of reconnoissance of which the aeroplane is capable are classified as follows: strategical reconnoisance, tactical reconnoisance, and the service of intercommunication. A modern aeroplane with a well-trained pilot can fly out a distance of 70 miles, reconnoiter the country thereabout, and return, within about four hours time, and be able to report the approximate strength, formation, and direction of movement of the enemy. But, as the value of the information depends to a great extent on the time which has elapsed since the events occurred which are being reported, it is highly important to have the aeroplane equipped with wireless and to be able to send back immediately reports of what is found. This is also true in the case of tactical reconnoissance, which is reconnoissance at short distance, when the cavalry is within close touch of the enemy's cavalry and can no longer advance. And in the service of intercommunication, the wireless is again brought into play to supplement the field telegraph and telephone services that are now so widely used. In other words, in reconnoissance work it has been found advantageous to supplement the work of the cavalry on the ground by aerial reconnoissance by means of air craft. France is the first country to work out the theory and practice of aerial reconnoissance. In the recent maneuvers the aerial corps was thoroughly organised and used as an aid to the cavalry. The nearly two-score machines in use were kept in operation so much of the time that in the two weeks of the maneuvers a distance of 42,000 miles was covered in flight. In numerous instances aviators flew from 500 to 700 miles a day, during the maneuvers.

The kind of machine to be used for various purposes has now been practically agreed upon by all the foreign powers, although France, of course, was the first to determine the various kinds of machines for different uses. These are as follows: For the cavalry, one-man machines that are rapid and light, as well as speedy, monoplanes being the principal ones used for this purpose. For the artillery, where observation is everything, two and three-seated machines are preferable. As slow speed is best for this purpose, biplanes are generally used. For long trips for strategic reconnoissance such as is necessary [illegible]

preferable; and finally, for practical reconnoissance, where the results must be immediately obtained, two-seated machines, either biplanes or monoplanes, are by all odds the best, as in such machines the pilot can be accompanied by an officer or a soldier who acts as an observer. It is preferable to have the observer a pilot as well, and to have the machine fitted with a duplicate control, so that in case of accident to the pilot, his observer may fly the machine and bring it safely to earth. In actual warfare, where there is danger of being hit by bullets, this is all the more necessary.

One very important point with regard to the military use of aeroplanes is the fact that in bad weather they can not operate. Fog, snow, heavy rain, or violent wind make it impossible for the aeroplane scout to do his work, and in the recent German maneuvers, during two days out of five, no flying was possible. On the other hand, after waiting for suitable weather, a fast monoplane can cover as much territory in a few hours as would require several days for a troop of cavalry to thoroughly explore, and aerial scouting has the further advantage that reports can be instantly transmitted by wireless.

Money That Really Talks

THE question of protection against counterfeit banknotes is one which is being discussed in England just at present. A member of the Royal Society recently showed the results of a discovery which he made, and by this means he is able to imitate copper or steel-engraved bank notes so perfectly that the president of a large bank was unable to pick out the single genuine banknote out of a lot of ten which included nine of the kind reproduced by the author. This was intended to show the error of the prevailing opinion that banknotes cannot be imitated. At the same time that this somewhat disconcerting news comes out, a new remedy against counterfeit notes is proposed, this being the "speaking" banknote, and should a system of the kind be adopted, the note will not only concern the eye, but will assert its genuineness in a loud and intelligible voice, should it be placed in a phonograph. In fact, the note carries a given phrase which is inscribed on the edge just as on a phonograph cylinder, using a specially propared paper for this purpose. Any kind of phrase can naturally be used, and its purport is of little importance, as it is designed simply to have a check upon the quality of the banknote by the use of the voice. All that is needed is to put the note into a properly-designed phonograph, when it will speak for itself, according to the present idea, while a counterfeit remains silent. The method is certainly an original one, but it would not seem a very hard matter to counterfeit the phonograph record as well as the note itself.

Electrical Energy for Reclaiming a River Bank

IN interesting contrast with the great hydro-electric generating transmission systems of which so much is heard nowadays, including schemes to utilize the water power of the great rivers of the country, an electrically driven plant for making a new river front at East St. Louis, Ill., is now in operation. With this equipment six million cubic yards of material are being dredged from the bed of the Mississippi River and deposited to transform a two-mile front of lowland, elevating the land to a level well above the high-water mark of the river. It is purposed to complete this undertaking within the next two years. The dredge performing this engineering work, equipped with special machinery for loosening the silt of the river bottom and then pumping it back a considerable distance to the "fill," is supplied with energy over a 2-mile, 13,200-volt transmission line, and has been in successful operation since August 15th. The main pump is of 1,000 horse-power and is capable of delivering about 800 cubic yards of solid material (constituting 15 to 20 per cent of the total fluid discharged) per hour.

NEW BOOKS, ETC.

HANDBUCH FÜR HEER UND FLOTTE. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant a. D. Unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Vollständig in 103 Lieferungen reichillustrierten Textes mit farbigen Beilagen, Karten, Plänen, Gefechtsskizzen usw. Deutsches Verlagshaus Bong & Co.

The wars of the middle ages are most elaborately discussed in the 38th to the 40th installments of this Army and Navy Hand Book. First of all, Dr. Walter Mehl gives a very clear account of the early art of warfare, with a very interesting analysis of the East German colonization movement of 1789 to 1842. By far the most important division of the subject of medieval warfare has been assigned to the editor of this particular volume, Dr. Francis Smith, a pupil of Delbrueck's. The very complicated wars of the medieval Italian states, complicated because they were so involved with political dissensions, he has discussed with admirable clearness. Wars in other countries are also taken up. Of the sixty-nine maps showing battlefields, contained in Volume IXa, Nos. 7a to 21 are to be found in the three installments before us. Since they contain all the geographical names referred to in the text, they constitute an invaluable aid in studying the great wars of the middle ages. Particularly interesting are the maps accompanying the discussion of the Arabian wars (622 to 1071), showing the remarkable expansion of Arabic sovereignty over three-fourths of the then known earth.

BATTLESHIPS OF THE UNITED STATES NAVY. From Photographs by E. Muller, Jr., Photographer United States Navy. Introduction by George von L. Meyer, Secretary of the Navy. New York: E. Muller, Jr. Price, 50 cents.

This excellent work is based upon several years' service by the author as official photographer to the United States Navy. It opens with a portrait of the Secretary of the Navy and a short introduction. Then follows a page explaining, in a graphic way, the difficulties under which photographs of ships in action are obtained. The majority of the photographs are 6½ by 9½ inches, and the one hundred or so pages are almost entirely filled with excellent reproductions of the ships of the navy. The book contains a good half-tone of every important battleship and armored cruiser, all of these being 6½ by 9½ inches. Then follows a remarkable series of photographs of gun practice, taken during the spring and autumn target practice. Some of these are already familiar to the public. Others are entirely new and were taken at the last maneuvers. The book also contains views of the life of the seamen and officers in detail, and in addition to target practice it includes views of torpedo practice, mine laying, and the various sports and pastimes which render life at sea attractive to the enlisted man. Of special interest will be some of the latest photographs taken at the moment of discharge of the big guns at the recent gun practice.

TEXT BOOK ON THE STRENGTH OF MATERIALS. By S. E. Slocum, B.E., Ph.D., and E. L. Hancock, M.S. New York: Ginn & Co., 1911. 8vo.; 372 pp.; illustrated. Price, $3.

In constructional work of all kinds a knowledge of the strength of materials is an important factor of efficiency, durability, and safety. Advantage has been taken of the opportunity afforded by this new edition to correct the few inevitable errors of the first, to amplify where necessary, simplify wherever possible, and to add such practical knowledge and material as the past five years have developed. The metals, mixtures, brick, stone, timber, rope, wire, and belting are all specifically considered, in addition to the general properties of materials and their behavior under stress and strain, with analyses of forces and practical formulæ. Part I.—the analytical treatment—is the work of Prof. Slocum, while the responsibility for Part II, the experimental or laboratory aspect of the subject, is assumed by Prof. Hancock. The aim has been to present the material so that it shall contain no insuperable difficulties for the technical student of junior grade.

THE STEAM TURBINE. The Rede Lecture, 1911. By Sir Charles A. Parsons, K.C.B. Cambridge: At the University Press, 1911. New York: G. P. Putnam's Sons. 12mo.; 57 pp.; illustrated.

It goes without saying that any lecture Sir Charles may give on the subject of the steam turbine is informative and well worth our time and attention. In this, its printed form, the lecture is enhanced by illustrations from *Engineering* and other sources. The author dwells upon the fact that the initial experiments in the case of the steam turbine were commenced on the strength of data furnished by physicists, which encouraged the belief that a successful engine of this nature was merely a matter of practical perseverance. More than a hundred thousand dollars was spent before an order was received. More recently an additional hundred thousand was expended in the effort to prove the advantages of mechanical gearing of turbines in marine work, and the success of this venture is set forth in a narrative of the accomplishments of the "Vespasian." The first Parsons turbine is the subject of a full-page illustration, and [illegible] engravings show the parts and [illegible] go to the completion of a [illegible] The Curtis [illegible] [illegible]

[illegible] and speed is [illegible] consideration of [illegible] the [illegible]

THE AUTOBIOGRAPHY OF JOHN FRITZ. New York: John Wiley & Sons, [illegible] 327 pp.; illustrated. Price, [illegible]

This autobiography is the [illegible] story of a plain, shrewd man who, with [illegible] education, fought his way to [illegible] native pluck, ingenuity, and [illegible] son of a German farmer, John Fritz [illegible] of the little army of pioneer [illegible] the foundation and started the [illegible] greatest industrial empire the world has ever known." His activities in connection with the iron and steel industry, the [illegible] the acid and basic open-hearth, and the [illegible] furnace, justly brought him commendation and honors from the colleges and distinguished engineering societies of this country and [illegible]. Those whose interests lie with iron and steel will read the autobiography as a simple but none the less truthful and charming delineation of certain phases of the industry. Those who may not fully appreciate the technical difficulties met and overcome yet must feel the [illegible] of the dominant chord of the work, the triumph of grit and integrity over almost insurmountable obstacles, while experience, shaped by will, in turn shapes and molds the life until it [illegible] as character.

THE RAILWAY SIGNAL DICTIONARY. An Illustrated Vocabulary of Terms which Designate American Railway Signals, their Parts, Attachments and Details of Construction, with Descriptions of Methods of Operation and some Illustrations of British Signals and Practice. New York: *Railway Age Gazette*, 1911. 4to.; 526 pp. Price, cloth, $3.50; full morocco, $6.

The title "Dictionary" does scant justice to the work, for it is in great measure a cyclopedia of the subjects it embraces, an illustrated catalogue, and a text-book or manual, all in one. Its information, compiled by the *Railroad Gazette* under sanction of the Railway Signal Association, is the more authoritative for having been supervised by a committee of the association. The first edition was issued in 1908, but developments in railroad signaling during the period 1908 to 1911 have been twice as extensive and important as in any previous period of equal length. Hence, the necessity of a revised edition that, while recognizing apparatus likely still to remain in extensive use for some time although no longer made, yet features the latest equipment. An historical sketch traces the adoption and progress of the block system on American railways. Tables show the extent of its use in the United States on January 1st, 1911. Then follows the dictionary proper, defining words, terms, and phrases used in signaling, and referring by page and figure numbers to the section of illustration and description. The remainder of the work consists of profuse illustration of every conceivable symbol, signal, and accessory, with descriptive text. Block signals, manual, controlled manual, and automatic, are fully and admirably treated, as are also interlocking systems and the multitudinous accessories. It will be understood that the work does not include hand-motion signaling, but deals only with fixed signals and with such equipment as automatic bells at highway crossings which, while it may not directly affect the movement of trains, yet comes directly under the attention and charge of the signal engineer. The dictionary should become an indispensable adjunct of the railroad reference library.

MARINE STEAM TURBINES. (Forming the Supplementary Volume to Marine Engines and Boilers.) By Dr. G. Bauer and O. Lasche. New York: Norman W. Henley Publishing Company, 1911. 214 pp.; illustrated. Price, $3.50.

Although the authors of this book are engineers in the employ of a great German electrical company, by whom a modified type of Curtis turbine is made, their book discusses the well-known Parsons type as well. Of the volume's practical value there can be no doubt. The authors are men who have been engaged in the actual building of turbines, and their formulas and directions are the result of a practical experience which it is difficult to acquire and frequently still more difficult to present in a book of this character. The task which they have set themselves has been accomplished admirably. The translation by Mr. M. G. S. Swallow is good. Moreover, he has done what few translators are capable of doing, that is, he has supplied an [illegible] foot note here and there and a few critical remarks, that undoubtedly add much to the value of the work. The contents of the book are as follows: General Remarks on the Design of Turbine Installation; Calculation of Steam Turbines; Turbine Design; [illegible] Condensing Plant; Arrangement of Turbines; General Remarks on the Arrangement of Turbines in Steamers; [illegible] les; Tables.

JAHRBUCH DER [illegible] GESELLSCHAFT. Vol. [illegible] Julius Springer. [illegible]

This year's volume of the [illegible] [illegible]

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12689) A. E. S. asks: Surfaces may appear to the eye to be in contact when they are not actually so. Even a convex lens leveled on a flat object does not touch it, and cannot be made to do so, even by a force of many pounds. Now, how much weight or pressure would it be necessary to make the objects touch? Can two objects be brought in absolute contact without uniting? Would a pressure of say 500 pounds still leave an intervening space between the objects? To be clear, at any pressure when two flat, hard objects do not unite, that is do not cohere, is there always an intervening space between said objects? A. We think it may be laid down as a safe criterion that when one surface is scratched by another, the two must have come into contact. We have many times had lenses scratched and marred by laying them down on a flat surface. We wish we could apply your statement to them and make the lenses believe that they had not touched the surface below them. It is our firm belief, though open to conviction upon proof, that surfaces do come into contact with very little pressure. In Prof. Spring's experiments at Liege, two bars of platinum were turned true and polished. When one was placed upon the other, they cohered and became one bar. A bar of copper placed upon a bar of zinc became one, and a yellow line of brass was seen where they united. No pressure was used beyond the weight of the upper bar, and the temperature was far below the melting point of the metals. You will find Prof. Spring's experiments in our SUPPLEMENT, 1305, which we will send you for 10 cents. Two surfaces can be brought into absolute contact without uniting. Prof. Spring brought non-plastic substances together, and could not make them cohere with any pressure he could bring to bear upon them, as is shown in the same article referred to above.

(12690) J. F. writes: In two very interesting articles in recent issues of the SCIENTIFIC AMERICAN, dealing with the flight of projectiles, many valuable and interesting points of information were laid before the laity. Gravity as I have learned in physics is an unvarying force. I was taught, and from experiments I conducted believe, that when two bodies spherical in form, of equal bulk, were suspended with their centers in the same plane, both would reach the earth at the same time, regardless as to whether one was merely dropped and the other projected into space on a line horizontal to the plane of the center. Evidently I have harbored a delusion these many years, for in your second article mentioned, the flight of a shell from a mortar is shown to rise in a given curve, while the curvature of descent differs. This it appears to me is in defiance of the laws of gravity, since the force of gravity acts upon the projectile with an equal force every moment of flight, both in arising and in descent. Kindly enlighten me further upon this matter, and advise me if the example I cite is in error. A. We do not think you need fear for the force of gravity because a shell from a mortar describes a different curve during its fall from that described during its rise. The resistance of the air to the motion of a body through it at a high velocity is very great, and the shell is moving much more slowly in the component of its flight, due to the powder, as it falls than it did when it left the gun. It falls much more directly toward the earth, as is shown in Fig. 8, to which you refer. The horizontal component of its motion has very nearly disappeared, because of the resistance of the air, and the shell finally plunges vertically down under the force of gravity alone. The laws demonstrated in physics for projectiles apply only to a space without a resisting medium, i. e. to a vacuum. The rise and fall of a shell from a mortar is not the equivalent of the experiment in physics of dropping one ball and shooting another horizontally. Both balls in the experiment are resisted equally in a vertical direction by the air, and both fall with an equal acceleration vertically, and hence are all the time of fall in the same horizontal plane at the same instant. A shell from a mortar, however, rises in a curve which has two components, one vertical and the other horizontal, due to the resolution of its velocity of discharge and the angle of elevation of the mortar. Its vertical component is destroyed by gravity and the shell ceases to rise. Its horizontal component is destroyed by the resistance of the air, and if the flight lasts till this is wholly destroyed, the shell would then be falling vertically point down by gravity alone, as shown in Fig. 8. It is in this respect that the actual flight of a shell differs from the theoretical path shown in the text-books. There would be little hitting in long distance target shooting if no allowance were made for the deviations from the theoretical trajectory due to various causes. Gravity acts exactly the same, both in the rise and fall of a shell, but the resistance of the air changes with the velocity of the shell, and herein is found the explanation of the point which troubles you. It did not come within the scope of the article in question to discuss this matter at all. We hope our treatment of it has made it clear.

More than 3000 purchasers placed their orders for the new 1913

Cadillac

Standard of the World

without seeing the car or even a photograph

We believe that this condition evinces a degree of confidence in a motor car manufacturer for which it would be difficult to find a parallel.

This year's Cadillac sales conditions are the conditions of last year, and the year before, and several years before that, intensified ten-fold.

Public opinion—always keen concerning a new Cadillac—has been stimulated to the point of intense eagerness by the 1913 features.

The long stroke, quiet, flexible engine of greatly increased power; the longer wheel base; the larger tires; the improved and simplified Cadillac Delco Electrical system (patented), of automatic cranking, lighting and ignition, improved and simplified as the result of the experience gained by the use of the old system on 12,000 Cadillacs; the automatic spark control—these and other 1913 features mean so much to the man who is convinced of Cadillac precedence to the exclusion of every other car, that anticipation has been amazingly aroused.

The past year we manufactured 12,000 cars, yet 90% of Cadillac dealers could have s ld from 10% to 50% more cars if we had been able to supply them.

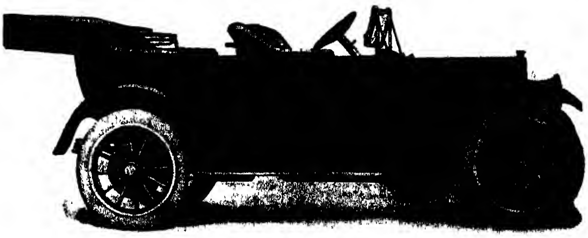
Obviously, many who desire to get Cadillacs failed to obtain them because they delayed placing their orders.

For 1913 the Cadillac Company is preparing to build 15,000 cars. Every one of these has been contracted for by our dealers and orders have already been taken by them for more than one-third of the entire production.

Our dealers tell us that this year's output will not be nearly large enough, but it is the maximum that we can produce.

In the light of previous experience and the present eager enthusiasm, your course therefore should be clear.

Simple prudence—and simple justice to yourself and to him—suggests the wisdom of an early conference with your Cadillac dealer, even though you may not want delivery of your car for several months.



STYLES AND PRICES

Standard Touring Car, five passenger $1975.00

Six passenger car	$2075.00	Roadster, two passenger .	$1975.00
Phaeton, four passenger .	1975.00	Coupe, four passenger .	2500.00
Torpedo, four passenger .	1975.00	Limousine, seven passenger	3250.00

All prices are F. O. B. Detroit, including top, windshield, demountable rims and full equipment.

CADILLAC MOTOR CAR COMPANY **DETROIT, MICHIGAN**

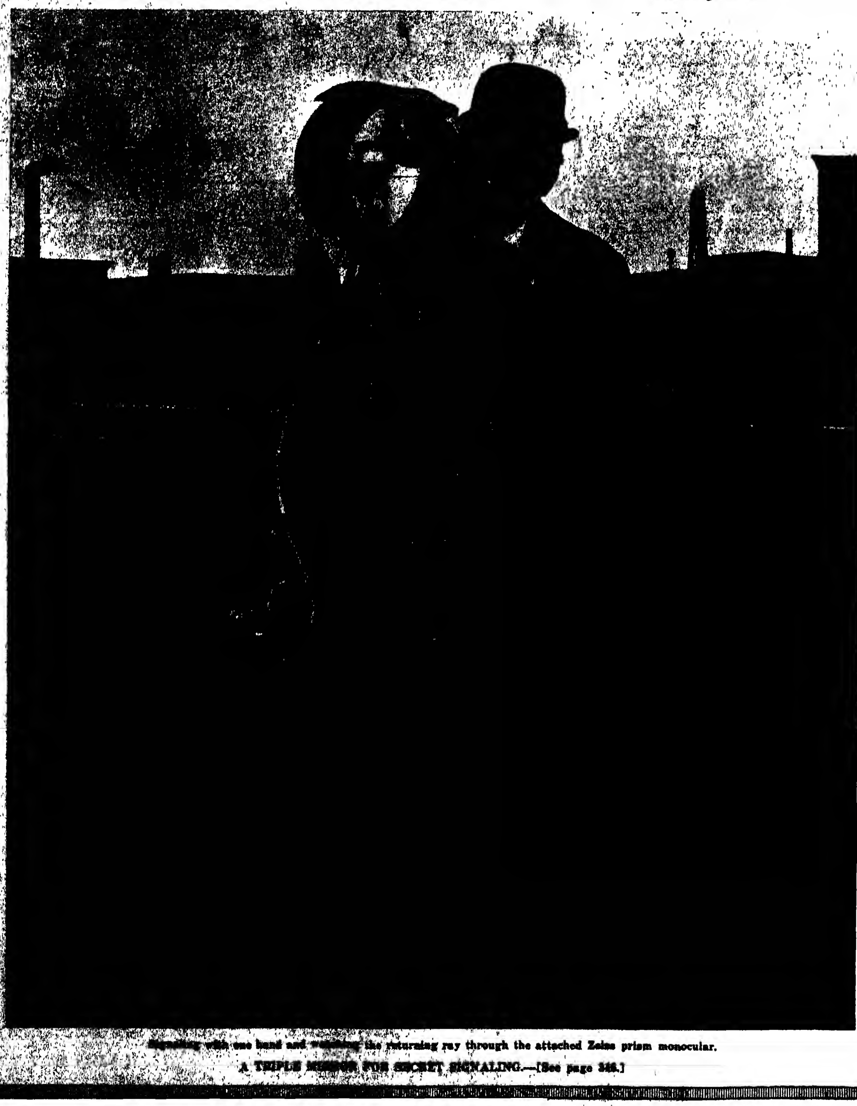
SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, OCTOBER 26, 1912.

[10 CENTS A COPY
$3.00 A YEAR



Signaling with one hand and watching the returning ray through the attached Zeiss prism monocular.

A TRIPLE MIRROR FOR SECRET SIGNALING.—[See page 348.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, OCTOBER 26, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer;
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year . . .	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid, . .	3.75

The Scientific American Publications

Scientific American (established 1845) . per year,	$3.00
Scientific American Supplement (established 1876) . "	5.00
American Homes and Gardens . "	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Physical Safeguards in Railroad Travel

IN three fatal disasters during the past few years, causing the death of twenty-three passengers, the New Haven Railroad has proved the futility of attempting to protect the lives of its passengers against dangerous crossovers by giving instructions to its engineers not to take the crossovers at a speed above fifteen miles an hour. The Bridgeport disaster, the second of its kind, led to a strong remonstrance and several recommendations from the Interstate Commerce Commission. Nothing, however, was done to remedy the defects, and a little over a year later a similar disaster, due to similar causes, occurred at the Westport crossover.

In the investigation of this accident by the Interstate Commerce Commission the vice-president of the road was asked "What action, since the Bridgeport accident and the report that was made on it under the auspices of the Interstate Commerce Commission, has the New Haven road taken to prevent a recurrence?" The answer was "We have done all we know how." As a commentary upon this reply, we invite attention to the article on the Westport wreck, and particularly to the diagrams and photographs which illustrate it, to be found elsewhere in this issue.

Perfectly natural was the oft-reiterated question of the members of the Commission as to why the New Haven Railroad had not lengthened its crossovers, or introduced some form of the automatic stop. The statement of the vice-president that the lengthening of crossovers would not prevent such disasters is simply preposterous. There is not a maintenance-of-way engineer on the whole 260,000 miles of railroad in this country, who would not wish to put in at express track crossovers the easiest switch that the local conditions at the track and the ingenuity of the switch-maker permit. It is all very well for the New Haven officials to talk of "stiffening discipline;" but they know very well, or it is their duty to know, that the safety of the traveling public demands, in addition to the stiffening discipline, that the tracks, the signal system and the rolling stock shall be made as proof against the errors of human fallibility as the ample financial resources of the New Haven Railroad Company can make them.

We look in vain for evidence that the company has made any effort to improve the physical conditions, even at those points which previous disasters had shown to be full of menace. The public may well ask "Why, with the example of the Pennsylvania and New York Central roads before it, to say nothing of the recommendations of the Interstate Commerce Commission, has the New Haven road been guilty of such neglect?"

The Nobel Prize Awarded to Dr. Carrel

IT is with special gratification that we Americans note the award of the Nobel Prize for Medicine to Dr. Carrel of the Rockefeller Institute for Medical Research. While Dr. Carrel is French by birth and training, his epoch-making researches have been for the most part conducted on American soil.

There is no need, in speaking to our readers, to more than briefly mention the principal products of Dr. Carrel's genius. He won his spurs in public recognition by his wonderful work in blood transfusion, of which an account has already been given to our readers in one of our August issues of last year. In 1909 he entered the Rockefeller Institute for Medical Research and began his investigations on the continuance of tissue life in excised portions of the animal body. These are of the highest interest, both from the point of view of pure science and also in their application to medical and surgical practice.

From the standpoint of theory it may well be said that our ability to cause the growth of living matter *in vitro* brings us perhaps one step nearer to that dream of the biologist—the production of living matter—which was so ably commented upon by Prof. Schäfer in his recent address. From the practical point of view several important reflections present themselves. Dr. Carrel has found that the medium which in normal life surrounds each tissue, is not the one best adapted for its growth. This implies on the one hand the possibility of perhaps stimulating the growth of certain organs or tissues, as the need may arise, by medication with specific substances affecting that particular tissue. It suggests, on the other hand, the possible opposite procedure of checking the growth of abnormal structures, such as tumor and cancers, by similar medication. It will be remembered that efforts in this direction were made some years ago by Prof. Beard of Edinburgh, unfortunately without any apparent success.

But what appears undoubtedly at present the most promising field of application of the results obtained by Dr. Carrel is the grafting of foreign healthy tissue in place of diseased or injured tissue. In order to be able to practise such transplantation as a matter of regular routine, and not as a mere occasional medical curiosity, it will be necessary to have on hand and preserve for use suitable portions of living tissues. The possibility of keeping alive for several months portions of excised animal organs placed in a suitable nutrient medium, as demonstrated by Dr. Carrel, is from this point of view of the highest interest. And the importance of this line of work is proved beyond peradventure by the successes recorded by Dr. Carrel in the actual transplantation of entire organs, such as the kidney, in animals. The new organ thus engrafted has been found capable of fulfilling in every way the functions of the normal and natural organ.

The Nobel Prize is intended as an award for achievements of no ordinary merit. So long as there are men like Dr. Carrel for candidates we need entertain no fear that the prize should ever lose any of the prestige which so justly attaches to it.

Farm Economics

THERE are many reasons why the subject of Farm Economics should command special interest. In the first place it concerns directly and personally a large and important class of our population. Then, again, indirectly we are all dependent upon the farmer for the most indispensable of all our supplies—our food. To the student of political economy the special branch of agrarian economics presents some features of particular interest owing to its fundamental character and its close relation to the most primitive wants of man.

Our Government is doing splendid work in collecting data which must be welcomed by each of these classes of persons interested, but most of all by the farmer to whom the question of the judicious distribution of his investment, to the best effect, among the several items incidental to farm management, is a matter of dollars and cents.

Bulletin No. 212 of the Bureau of Plant Industry, "A Study of Farm Equipment in Ohio," gives a most valuable review of important data of this character gathered and collated with much painstaking care by Mr. L. W. Ellis.

On twenty-one farms investigated the following was found to be the average distribution of capital invested: In land, drainage and water supply, 61 per cent; in buildings, 21 per cent; in implements and machinery, 5 per cent; and in live stock, 13 per cent. The bulletin gives much detailed information, of which the figures just quoted represent a gross summary.

Ours is the day of scientific management. No longer need the farmer slowly find his way to the best working conditions by a series of successive approximations—the Government helps him to profit by the experience of others, who have preceded him, and have paid the heavy dues of that excellent but dear schooling.

The Problem of Launching the Naval Hydro-aeroplane

THE development of the hydro-aeroplane seemed at the very beginning of its dual application to promise speedy acceptance by the navy as a military adjunct for the purpose of scouting. The partisans of this modified aircraft lost no time in making all sorts of extravagant claims for it. According to them, the fleet was to have new eyes at a small cost, and the aviator was to do prodigious things in the way of helping the fleet commander to guard against surprise while himself taking advantage of every opening presented by an unwise maneuver on the part of the enemy.

There are some physical conditions which, unfortunately, make the practical acceptance of the aeroplane on shipboard hard to realize. The notable flights of Ely from the U. S. S. "Birmingham" two years ago and the later performance of the same aviator in flying to the U. S. S. "Pennsylvania" and returning from that ship, showed what could be done under favoring conditions; and they also proved that the aeroplane was quite unfitted for associate operations with a craft at sea—especially if the flying machine was forced to take to the water. The extremely cumbersome launching and landing platforms, well enough for an experiment, could not be tolerated on a fighting ship in time of war. The logical outcome was the hydro-aeroplane. The very frailty of the flying machine marked it an easy prey for rough waters; and while its pontoons might serve to add an element of safety for the benefit of the aviator, still they could promise but little protection for the planes and general structure if exposed to waves of any force and weight. This has been discouragingly exemplified upon many occasions up to date. It was evident that even the water-plane was no better than the aeroplane, if it had to start from the water or return to that element when the surface was much agitated. Accepting, then, the pontoons as features of safety, the next logical effort was in the direction of finding an efficient means for getting the aircraft away from the deck of the ship.

The problem of successful launching has been given much thought, both here and in Europe. On the other side of the Atlantic the *pros* and *cons* of the Wright launching rail have been discussed with more or less thoroughness, and among naval aviators it is generally looked upon as a possible last resort, but not the ideal demanded by the conditions afloat and the requirements of the latest types of high-speed machines. Shortness of runway is arbitrarily fixed in a measure by the essentially military features of the man-of-war, and for that reason some form of impulse had to be devised which would give the aircraft the needed velocity of headway within a short distance. Capt. Washington I. Chambers, U. S. N., has been quietly working for months upon a launching apparatus which, in effect, is a sort of pneumatic catapult. This mechanism received its initial test at Annapolis during the past August, and while the aeroplane took a tumble, still the broad idea of the installation gave gratifying promise. It is quite probable that when the control of the impulse and its acceleration are properly adjusted, the apparatus will prove quite practicable within limits. However, it is not a question of throwing a solid mass into the air, but the far more delicate problem of getting a sensitively balanced kite, as it were, started on its flight against the opposing air. The tests at Annapolis clearly showed how disturbing was the effect of a slanting wind and how necessary it probably would be to get the aeroplane launched squarely against the breeze. Even though the catapult be installed so that it can be made to face the wind, that does not dispose of the difficulties. A big ship in motion very seriously modifies the streamlines, so to speak, of the air currents, and the higher the speed of the vessel the more profound the aerial perturbation. Only big ships will be able to carry associate aircraft, and here we have another aspect of the question to vex the experimenter. Only a short while ago, an Italian aviator was maneuvering in a hydro-aeroplane over the waters of the Gulf of Spezia. By chance, the battleship "Dante Alighieri" was running some of her trials at the same time. The "Dante Alighieri" is credited with a full speed of something over 24 knots an hour. Whether she was running at her highest rate then is not certain; but the aviator, swinging through the air across her wake, suddenly found his machine beyond his control, and down he plunged into the water. The mishap was unquestionably due to the disturbed condition of the air produced by the passing battleship.

Of course, there is a point forward on a ship under way where the air passing sternward probably flows fairly evenly, and the studies of the naval aviator must be twofold: first to evolve a satisfactory launching machine and then to place that apparatus where it may do its work with the least risk to the aircraft. The public should not be hasty in its judgment or rush in its conclusions. All of these difficulties will be skilfully overcome in time, but the hour for the aeroplane on shipboard has not yet arrived. It must be remembered that there are the corresponding difficulties of returning to the ship after a flight. Will the flying machine be able to make a successful landing aboard if a wind is blowing and the air currents are much disturbed? This is decidedly debatable.

Electricity

Street Lighting as Police Aid.—An Indiana city has recently utilized a special street lighting system that had been installed for ornamental illumination to assist the police in case of an alarm after the lights have been turned off at night. A controlling switch in the office of the chief of police enables the lights to be flashed on while officers are scouring the streets.

The Smallest Dynamo in the World.—An electric generator only 15 millimeters in height, weighing only 7 grammes and wound with silk-insulated wire was recently exhibited before the French Academy of Sciences. The armature of this diminutive machine is 6.2 millimeters in diameter, and the commutator and brushes are constructed as accurately as in a large machine. The output is about 2 amperes at 2.5 volts.

Photo-telegraphy Without Selenium.—Paris daily newspapers are beginning to use pictures transmitted by a method employing a copper plate prepared from the original photograph negative. This transmitting plate resembles a half-tone plate and consists of parallel lines in gelatin upon the copper surface. In the black parts of the picture the lines are wide, covering nearly all the space, and in the whites they are very narrow. The plate is wound around the cylinder of a transmitting instrument, synchronized with a receiving instrument which operates by the deflection of a beam of light.

Electrical Operation of a Bascule Bridge.—An electric motor-operated bascule bridge of a railroad company over the Calumet River, near South Chicago, Ill., is supplied with power from an isolated plant with an equipment of storage batteries. The object of the auxiliary storage battery plant is to enable an electric generating plant of small capacity to be utilized without overloading of the generators or risk of failure in the operation of the bridge. The electrical control of the bridge is interlocked with the signal system of the railroad trackage passing over the bridge, so that it is impossible to receive any current on the controller until the proper signals have been set.

The Part of the Electric Motor in Irrigation Work.—The irrigation of what used to be known as the Great American Desert has shown this strip of country to be very fertile land that had needed only adequate water supply, and the extension of irrigation has been part of the development of several of the great electrical transmission systems in the arid zone. At the same time the more refined experience with irrigation has shown an important application of the electric motor, viz., for the pumping work necessary to make the newly provided water supply available to the farmer. The actual amount of water needed (under skillful farming) is small and may be brought to the farmer's very door by motors supplied with electrical energy at a favorable rate, viz., $20 per horse-power for the six months' season.

Co-operation in Power Supply.—Nowadays the co-operation of public service companies not only helps out with the supply of many things which formerly all individuals and concerns had to provide for themselves, but gives a commodity of better quality than the small consumer could possibly afford otherwise. The electricity supply companies, especially, step in to give many private consumers far better light and power in both home and workshop than they could provide for themselves. This important feature of modern civilization is brought to mind in a recent number of a German electrical paper, pointing out the superiority of the electric motor over the gas or gasoline engine under certain conditions. Where the load is intermittent and relatively small and the ruling considerations are convenience, simplicity, and cleanliness, using the electric motor, that is, energy delivered by wire from a central generating station, is a cheap solution of the power problem. When power is required for long periods and in large amounts, however, there is a point beyond which the internal combustion engine will be cheaper than the motor.

The Vogue of the Steam Turbine in the Generation of Electricity.—The large extensions to electrical supply equipment in Chicago that are now in hand call attention to the vogue of steam turbine generators in the huge projects at the present time superseding the engine-driven generators that were universally employed in the earlier days of electrical engineering. For the Fisk Street Station, Chicago, a 25,000-kilowatt, 4,500 volt, 3-phase Parsons' horizontal unit, having a speed of 750 revolutions per minute, is now under construction. This generator will be about 75 feet long and 18 feet wide. The addition to the plant will be large enough to house four of these units, bringing the ultimate capacity of this station up to 220,000 kilowatts. The project for the new Northwest Station in the same city comprises twelve 20,000 kilowatt vertical steam turbine generators to be housed in two similar groups of buildings, and two of these units are now installed. The rotating member, containing six disks with a total of 7,392 buckets and weighing almost exactly 100 tons, is supported on a step bearing which is supplied with oil at a pressure of 800 pounds per square inch.

Aeronautics

Monoplanes Abandoned by the British Army.—Following the example of the French, the British government has decided to use only biplanes for military purposes. The many deaths that have occurred in the last few months is the obvious reason.

Test of a New Wireless Apparatus for Aeroplanes.—A wireless apparatus recently designed for torpedo boats and submarines is being tested out in a Curtiss military biplane at Hammondsport, N. Y. The generator is said to weigh less than five pounds and to be driven by a source of power other than the aeroplane motor, so that it is not affected by accident to the latter. On October 14th this machine was flying above Lake Keuka at night with a powerful searchlight, which would go out every time the aviator sent a message and would light up again as soon as he stopped sending.

Two Airship Patents.—Frederick Brackett of Washington, D. C., has secured patents, Nos. 1,039,092 and 1,039,251, for airships, the former including a steering mechanism which has a frame alongside the craft and inclining downwardly toward one end of same with a number of planes spaced apart in the frame. The patent, No. 1,039,251, has a number of containers each formed of an elongated and pointed element substantially rectangular in cross section and curved longitudinally with the containers arranged side by side in superposed groups in such manner as to provide planes, suitable propelling means being provided.

Russian Military Aviation.—The Russian military aviation concourse was opened on September 4th at the St. Petersburg aerodrome, and is the first one of any account to be held in the country. Eleven aeroplanes were entered, most of which, like the "Sikorsky," "Dux," "Haeckel" and others, were of home make There were also two German flyers entered. The conditions were as follows: A continuous flight of 1½ hours with a load of 400 pounds, and gasoline and oil for a 3-hour run. Six speed flights, forward and back in straight line, a 15-minute flight at 1,500 feet height, and a 10-minute flight with an extra heavy load. Also mounting and dismounting the apparatus, hard flights from plowed or grass-covered fields, and the like. The three prizes were $16,000, $8,000 and $5,000.

Safety of the Hydro-aeroplane Again Demonstrated.—On October 11th, Marshall E. Reid, the young Philadelphia aviator, and Lieut. Com. H. C. Mustin, of the Philadelphia Navy Yard, attempted to fly from Cape May over Delaware Bay to Philadelphia. The flight was made in Mr. Reid's Wright biplane which he has equipped with floats, lately. Some time after the start of the flight, while the men were 500 or 600 feet above the waters of Delaware Bay, a cylinder head blew off and the aeroplane dived to the surface of the bay. In some unaccountable manner the gasoline caught fire, and the machine was ablaze when it struck the water. The occupants managed to put out the flames, but as the weather was foggy, there was nothing that could be done except to wait until they were located. They were eighteen hours upon the leaky pontoons before an oyster patrol boat picked up the men and their machine and landed them at Port Norris, N. J. After this adventure young Reid is highly in favor of the hydro-aeroplane as he believes if the accident had happened above the ground both he and his companion would have been killed. It would be well to have some sort of a shrill signaling device on an aeroplane, that could be used in case of an accident like this in foggy weather.

Opening of the Aeronautical Society's New Field.—The new aviation field recently secured by the Aeronautical Society at Oakwood Heights, Staten Island, was auspiciously opened on Columbus Day by a model aeroplane contest and a number of exhibition flights by leading aviators. Three records were broken in the former events, and the finish of the program was a daring parachute jump from Harry Brown's Wright biplane by Frederick Rodman Law, this being the sixth time that this daring parachute dropper has performed this feat in mid-air. He carries the parachute folded upon his shoulders and attached to a sort of harness of heavy leather straps passing around his body and limbs. He made the leap from a height of 5,500 feet and was nearly ten minutes in descending to earth. Mr. Brown, despite his injured wrist, handled his machine splendidly and there was no perceptible waver when Law jumped overboard. Mr. Law's sister, Miss Ruth Bancroft Law, also made a pretty exhibition flight in her Wright biplane, and Mr. E. Weeks of Scranton, Pa., made an exhibition flight in a novel combined Curtiss and Farman biplane. Shooting at bunches of three or four toy balloons by Mr. Dillon Hoffman while circling about in Brown's machine was another feature of the exhibition. Mr. Brown was unable to operate his Wright in a gusty wind so that Hoffman could hit the balloons, although the latter holds the record of hitting eighteen out of twenty balloons. Over 6,000 people attended the meet. The interest and enthusiasm manifested prove that aviation is not dead in America.

Science

New Director of Dudley Observatory.—Benjamin Boss has been appointed to succeed his father, the late Dr. Lewis Boss, as director of the Dudley Observatory. Mr. Boss was born in 1859. On graduating from Harvard University he joined his father in the work at the Dudley Observatory In 1906 he became Director of the United States Naval Academy Branch at Patmla, Formosa, which position he held for three years.

Progress of Cremation in Europe.—There has been a marked increase in Europe in the use of cremation as a method of disposing of the dead. Last year there were 7,555 cremations in Germany as against 6,500 in 1910. At present there are thirty crematories in Germany and almost as many in Italy. In England there were 1,033 cremations in 1911 as against 840 in 1910 Recently Switzerland has passed a law which practically makes interment exceptional

Ageing Yellow Leather. Max de Nansouty says in *Les Annales* (Paris), "A specialist gives us the details of the following process for imparting to new yellow leather a look of age. It is first washed with plenty of water and thoroughly dried; then the surface is coated with a layer of vaseline. When this layer has been absorbed by the leather another is applied, this being kept up till the leather is saturated. Only four applications at most are required to give the leather a very deep color. When dry it will be dull, but a polish may be imparted to it by any sort of encaustic

Artificial Cow's Milk.—A recent press dispatch states that three German chemists at Frankfort-on-the-Main have discovered a method of making milk synthetically in the chemical laboratory According to the dispatch several scientists, including Sir William Crookes, tasted and tested this milk and pronounced it palatable. It is proposed to manufacture the milk in London and sell it at six cents a quart. The milk is made entirely from vegetable ingredients digested in a "mechanical stomach" Be that as it may, we hope that there is some truth in the report, for there could be no danger of tuberculosis or any other disease germs in the synthetic product.

Purification of Coal Gas.—One of the most valuable and original of the communications before the Eighth International Congress of Applied Chemistry was one by Dr. J C. O'Neill. It relates to the continuous purification of coal gas with weak ammonia. The gas that leaves the condensers is washed with a weak liquor of ammonia, instead of with the gas liquor itself, found in the first scrubber Thereby the whole of the cyanogen is absorbed and also the greater part of the hydrogen sulphide. The temperature of the gas and the wash liquor should be above 30 deg. Cent The wash liquor from the scrubber is returned to the ammonia still, and the impurities saturate the concentrated ammonia in the condenser of the still. Six months' trial of the process showed that the oxide in the purifiers was insufficient to deal with the gas when the latter was washed with liquor in the ordinary way.

Death of a Prominent New York Chemist.—On the eighth of this month the death was reported of Prof. Morris Loeb, who has for many years past figured prominently among the chemists of New York city. Dr. Loeb was formerly professor of chemistry at New York University, but had of recent years retired to conduct researches in his own private laboratory. His work dealt chiefly with certain phases of inorganic and physical chemistry. But his activities were not confined to the direct advancement of science alone. He will be specially remembered for his public services, and, among chemists, for the active part taken by him in founding the Chemists' Club and in raising a building fund for the headquarters of that club, completed in 1911. He held the office of president in this organization in 1909 and 1912. At a special meeting of the Board of Trustees of the Chemists' Club of New York city, held October 8th, the following resolutions offered by a committee consisting of Mr. Ellwood Hendrick, Mr. Clifford Richardson and Mr. Walter E. Rowley were adopted.

Whereas, Morris Loeb, the president of the club, has been taken from us by death, and

Whereas, He was the leading spirit in bringing to fulfillment ambitions and plans that had long been ours, and

Whereas, He was always ready to shoulder burdens and to give help, and

Whereas, He was a man of order, and of integrity in mind and in heart, sincere in scholarship, living without malice or scorn, speaking no evil, and generous in judgment, and

Whereas, We were drawn to him by ties of deep and abiding affection, now, therefore, be it

Resolved, That we make this minute of our poignant grief at his passing, and that we cherish his memory as another of his great gifts to science and to humanity.

The "Immortality" of Tissues

Its Bearing on the Study of Old Age

By Genevieve Grandcourt

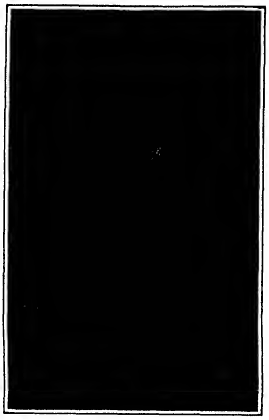
A VERY evident disadvantage under which medical science has labored has been the impossibility of watching the chemical process set in motion by substances introduced into the body. For this reason various experimenters, from time to time, have attempted to "grow tissues" artificially, in such manner that their development, functions and decay—under both healthy and diseased conditions—might be studied under the microscope. The only way in which this could be done would be to take a piece of living tissue from the body, and cause its cells to multiply; tissue being made up of an aggregation of cells.

Science has failed to produce a single living cell, that is, a cell which will undergo the process of nuclear division (growth) which is the prime condition of its being, and it seemed equally impossible to cause a cell already living to undergo the same process if deprived of the circulation of the blood. Therefore, when in 1910 it was announced that Dr. Alexis Carrel with his assistant, Dr. M. T. Burrows, had succeeded, scientific credulity was taxed. A well known French savant expressed the opinion before the Society of Biology in Paris, that as others experimenting along these lines, had witnessed only degeneration and survival of cells, this phenomenon was all Carrel's discovery amounted to. In view of past experience, indeed, the chances were in favor of a mistake. In 1907, Leo Loeb said that he had produced this artificial growth both within and without the body. Obviously, such development within the organism where the process of utilizing the body-fluids, etc., follows the same course as in nature, takes on the character of grafting rather than of cultivating in a culture medium. As to causing the external growth, it was ten years later before it seems first to have succeeded. In 1907 Harrison, from Johns Hopkins University, furnished details of his research in such form as to be convincing. But his work had reference to the growth of tissues only of cold-blooded animals, he having cultivated artificially, nerve fibers from the central nervous system of the frog.*

Carrel's work consisted in extending Harrison's method to apply to warm-blooded animals, including, of course, mammals; he having primarily in view at this time a more precise knowledge of the laws governing the *restoration of tissues, for example*, after serious surgical wounds. He and his assistant worked steadily to this end, and succeeded. The tissues of the higher animals, including man, *can* now be developed in *a* culture, and such development can be made to correspond to a rigidly precise technique. The feat is accomplished by putting minute pieces of living tissue into a plasmatic (blood) medium which will coagulate. So complicated is this apparently simple matter in its application that only the most exquisite surgical skill is proof against incalculable modifications in results.

The plasmatic medium in which the growth takes place consists of blood which by a centrifugal process has been deprived of its cells. Generally speaking, it must be taken from the animal whose tissue is to be cultivated or from an animal of the same species, although chicken-tissue has been grown variously in the blood of human being, dog, and rabbit. The tissue is excised from the etherized subject under circumstances which are an absolute guarantee against bacterial infection, tearing, chilling, drying, etc., and so liable is tissue to be killed by exposure to the air that it is safer to dissect it in serum. Both plasma and tissue may be kept in cold storage, although the time within which each can be preserved varies largely with the different species of animals. The plasma of the rat is useless in much less than a day, while that of the chicken can be kept over a week without coagulating. The dependence of great results upon minute causes is shown by the fact that the tissue from which the growth is to take place must be exceedingly small; the reason being because only the outer edge of the tissue can get nourishment when deprived of the normal blood circulation. When the tissue is of any extent, all but the periphery dies.

* *Journal of Experimental Medicine*, Volume XIII, No 3, 1911, p 388



Dr. Alexis Carrel, who recently won the Nobel Prize.

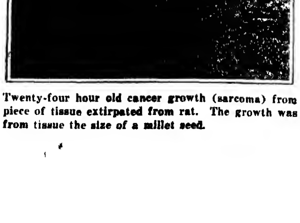
In order to view the changes in form (morphology) of the cells, small quantities of tissue are grown by putting a tiny piece cut from the excised fragment on the inside of the cover of a glass-slide, and overlaying it very thinly with the prepared plasma. When the cover is adjusted to the slide and sealed with paraffine (to keep the culture moist) it is quickly put into an electric incubator and taken into the observation-room to be deposited in the large incubator provided with a powerful microscope. The plasma coagulating either when it receives the tissue or at once upon feeling the heat of the incubator, the tissues grow in what is described as "the hanging drop culture" downward into the glass-slide. The growth can be observed after a latent period varying according to the nature of the tissue, the time elapsing since it has been deprived of circulation, etc. The microscope shows the direct division of the nuclei, and the growth taking the form either of layers or of so-called "radiating chains," depending upon whether connective or epithelial tissue is being developed. In other words, the cells either spread far out into the medium or pack up, so to speak, in a dense mass.

So far *so* good. But it is necessary to study not only the morphology, but the dynamics (movements) of the cell-multiplication. For this latter purpose, a large quantity of tissue was grown *on plates*. More recently, both kinds of culture have been modified "with the view of obtaining better support for the cells and better nutrition for the cultures," but the process is too involved to be described in a paper of this length. Having obtained evidence that tissue can be cultivated in accordance with a formula that may be relied upon to give definite results, the effort was made to grow artificially the various malignant (cancerous) tissues, in turn of chicken, rat, dog and human being. Cancerous tissue invariably developed cancer, and so rapidly and extensively that the growth could be observed with the naked eye.

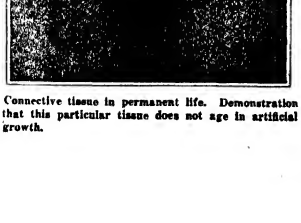
It now became evident that, under the right circumstances, the artificial growth of tissues could be utilized in the study of many problems; such as malignant growth of tissue; certain problems in immunity, as, for example, the production of anti-bodies and antitoxins of certain organisms; the redintegration of tissues; the regulation of the growth of the organism, or of different parts of the organism; rejuvenation and senility; and the character of the internal secretions of the glands, such as the thyroid which plays a rôle most important in physical and mental development. The difficulty lay in the fact that the artificial growth was so very short-lived. It was found that by passing the growth into a new medium, and repeating the process, the tissues would begin to grow again; but their life even under these circumstances was limited at the most to twenty days. This was manifestly too short a time in which to study the fundamental questions to which the researchers had addressed themselves. Thereupon, study was taken up to determine the question as to *what made these tissues die*. It was found that, apparently as incidental to growth, there was the process of decay, due to an *inability of the tissues to eliminate waste products*.

On January 17th, 1912, experiments were commenced to determine whether these effects could be overcome. The observations were on the heart and blood-vessels, artificially grown, of the chicken fetus; the tissue being taken from an embryo of seven and an embryo of eighteen days. These growths were put into a salt solution (Ringer's) for a few minutes at different periods of their growth, and then placed in a new plasmatic medium. It was found that by following this method, the tissues could be made to live indefinitely; and the conclusions were drawn by the following very curious facts. When an animal is in the early stages of its development, the growth of its tissues is necessarily greater than as it matures, there being steady

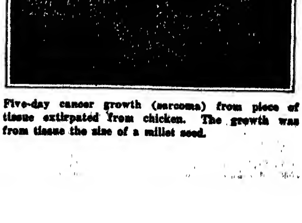
(*Continued on page 354.*)



Twenty-four hour old cancer growth (sarcoma) from piece of tissue extirpated from rat. The growth was from tissue the size of a millet seed.



Connective tissue in permanent life. Demonstration that this particular tissue does not age in artificial growth.



Five-day cancer growth (sarcoma) from piece of tissue extirpated from chicken. The growth was from tissue the size of a millet seed.

Lesson of the Railroad Wreck at Westport

The Imminent Peril of the Short Crossover

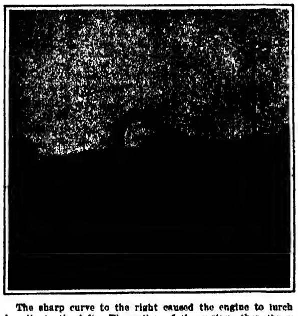
ON July 22d of last year the SCIENTIFIC AMERICAN, in commenting on the disastrous crossover wreck near Bridgeport on the New Haven lines, said: "It would be entirely possible to lay out the tracks with switches and curves so easy, that, if a heavy express train disobeyed its orders and swept over a crossover at a speed of sixty miles an hour, it could do so without any grave risk of derailment."

Fourteen months passed away without the New Haven Railroad taking any steps to lengthen its crossovers, with the result that about the sunset hour of a September day, and at a point on the company's lines only a few miles distant from the scene of the Bridgeport wreck, that disaster was almost exactly duplicated. An express train, drawn by one of the heaviest engines on the division, dashed by the signals and swept at a speed of from fifty to sixty miles an hour over one of these death-trap crossovers, whose length, in this case, did not exceed 200 feet.

Had the New Haven Railroad Company done its duty, torn up these crossovers and rebuilt them according to the best modern engineering practice, as carried out on the New York Central and the Pennsylvania Lines, that express train, even had it been running at sixty miles an hour, would have passed through without derailment, and the ghastly horrors which followed would have been prevented.

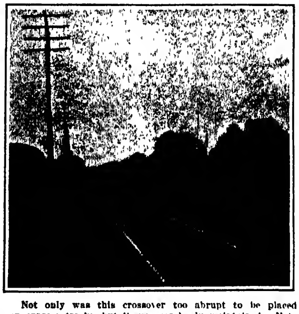
In the investigation of the accident by the Interstate Commerce Commission, at which the writer was present, the leading officials of the railroad took the most astounding statements must be characterized as some of the most astounding that ever came from the mouth of a responsible railroad official; for they can mean nothing else than that this company refuses to do what it can in a physical way to render crossovers safe. In other words, the policy is to trust everything to the always fallible human element, and refuse to make those physical changes in the tracks, which would reduce the danger, due to disobedience or neglect, to a minimum.

We are fully satisfied that there is not a single railroad engineer—certainly not an engineer of maintenance of way—in the whole United States who would subscribe to the last statement of Vice-President Horn. As a matter of fact, crossovers on express tracks can be made absolutely safe for the fastest speed at which an engineer can pull his train through them. Has this witness never heard of the Pennsylvania Railroad? Does he not know that on the main lines of that road crossovers have been built within the past few years with a special view to eliminating risks due to disobedience of orders by engineers? Does he not know that on that road there are crossovers which are so easy in curvature and of such great length, that the railroad has imposed no speed limit whatever upon the engineers in running over them?



The sharp curve to the right caused the engine to lurch heavily to the left. The action of the springs then threw the engine over to the right. In this position it entered the second curve, which completed the overturning.

Westport switch, looking west.



Not only was this crossover too abrupt to be placed on express tracks, but it was carelessly maintained Note the sharp jog in the curve at the point indicated by the arrow.

Westport switch, looking east.

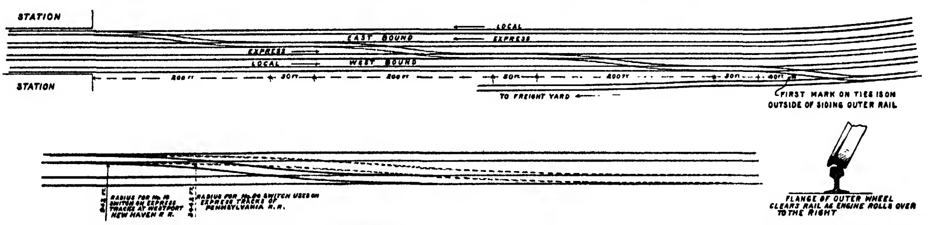
those of convenience and economy The freight yard for the handling of goods destined for or shipped from Westport and Saugatuck, lies on the north side of the tracks, and is entered from a siding whose switch is distant about 750 feet to the westward of the station. For the accommodation of freight cars destined for Westport, three crossovers connect the two eastbound and the express westbound tracks with the siding and the yard For a distance of about seven hundred feet to the west of the station the tracks are on a tangent. Then commences a curve to the left Because of the super-elevation of the outer rails on these curves, it was impossible to place any of these crossovers on the curve, and consequently they were restricted to a distance of about seven hundred feet To get them within the limited space available, it was necessary to use a short crossover—in this case what is known as a number ten In addition to serving the freight yard, these crossovers are used to transfer express trains from the local to the express tracks or *vice versa*, when the expresses have to make station stops, or have made them and wish to return to the express lines.

Now, in view of the fact that express trains on this line frequently run at speeds of seventy miles an hour or over, and in view of the fact that the human element as represented by the engineer is fallible and that the engineer, however good a man he may be, is liable to forgetfulness, momentary carelessness, or physical disability—due regard for the safety of the traveling public, should have led the company to place some of these crossovers to the east of the station and others to the west of it, making them of such a length and with such easy switches and frogs, that in case the speed order was disobeyed the train would pass through without risk of derailment.

As a matter of fact, considerations of convenience, economy, or what not, led the company to crowd all three crossovers into the restricted space between the station and the point of curve (commencement of curve) seven hundred feet distant. Short crossovers were put in and a standing order was made that they were to be taken at a speed not to exceed fifteen miles per hour.

In this case, as in the accident at Bridgeport, fourteen months before, the engineer swept through the crossover at a speed, as estimated by witnesses, of from fifty to sixty miles an hour Strange to say, the huge engine passed through intact; but in doing so the great centrifugal forces developed set up a rolling action which threw the engine entirely from the track. When it struck the first switch, the reaction of the sharply-curved rail caused the engine to lurch heavily to the left. Then, on the rebound, with a pendulum-

(Concluded on page 358.)



The upper drawing shows how three crossovers were crowded into the 700 feet between the station and the curve to the left

The lower sketch shows the sharp curvature of the New Haven No. 10 crossover compared with the easy curvature of the Pennsylvania No 20 crossover The overturning effect of the No. 10 is nearly four times greater

The right and the wrong way to lay out express track crossovers.

position, that, since they had made a standing order that this particular crossover was not to be taken at a speed of over fifteen miles an hour, the sole responsibility for the wreck was to be placed upon the engineer of the train. Furthermore, they did not hesitate to assert to the Commission that they had done everything practicable in a physical way to prevent such an accident. The attitude of the New Haven road is shown by the following extract from the evidence, as printed in the daily press:

"By Mr. Higgins (of the Commission): Would not the lengthening of crossovers at least materially decrease the element of danger? Answer (by Vice-President Horn): We feel that it would only be a question of time until men took the longer crossovers as much too fast as they take the shorter ones.

"Question: But would not the element of danger be decreased? Answer: I would state that in the end the longer crossover would make the situation worse. It would be putting a premium on violation of the rules." Again, the same witness is reported to have said: "We couldn't find that lengthening that crossover" (at Bridgeport) "would have helped the situation any." If the vice-president is correctly reported, these

If the New Haven high officials, those who have to do with the appropriation of the necessary funds to carry out improvements suggested by its staff of engineers, are in ignorance of these facts or blind to their significance, the SCIENTIFIC AMERICAN invites their attention to the accompanying photographs and diagrams, showing the existing dangerous conditions at Westport in contrast with the up-to-date methods of construction adopted on more than one of the first-class roads of this country.

It will be evident to any railroad engineer who studies the accompanying plan of the track layout at Westport, that the motives which led to the creation of and persistence in the present conditions there, are

A Triple Mirror for Secret Signaling

Reflected Beam that is Invisible Out of the Path of the Beam

By C. H. Claudy

ONE of the most recent applications of pure mathematics and the science of optics to warfare is found in the triple mirror, in which the optical principle that "the angle of incidence is equal to the angle of reflection" has been utilized to make a device for secret signaling which is at once effective and portable. The success of the apparatus depends entirely on the discovery and manufacture of apparatus of sufficient accuracy to plane and polish glass into an exact right angle!

The triple mirror, as the frontispiece shows, is, in appearance, merely a round brass case, which can be held in the hand, hung to a mast head, carried over the shoulder or swung from a saddle. Here it is mounted on a tripod. But the most casual glance at it will reveal its peculiarity, which is that no matter in what position it is held, the observer can see in it his own face He may look directly into it, or look at it from either side, or from above or below—yet always he sees his own face exactly as when directly facing an ordinary mirror

The principle is that partially shown in the diagram The mirror itself is a single prism of glass (Fig. 1) the three sides of which are each at right angles to the other at the apex and the base of which is at a forty-five degree angle with the three faces of the pyramid. It may better be described as a corner cut off from a glass cube It is difficult to show three sides in a two dimensional diagram without confusing the light rays, so but two faces are shown in Fig. 2 It illustrates, however, the fact that the emergent ray of light is sent back by the mirror parallel to the incident ray of light; and this holds true in the mirror itself, with the addition that the third reflecting surface permits this condition to obtain, no matter what the angle between light and surface of the mirror may be.

The mirror may be carried or hung anywhere. A beam of light focused on it from a distance may be visible to anyone at night, yet the return beam, which is parallel to the incident beam and continues with it, is not visible on the darkest night to anyone save the observer who stands directly in its path If now the mirror be capped and uncapped by the one signaling, those signals are perfectly visible to anyone in the path of the returning ray, but utterly invisible to anyone else

A horseman scouting across country could be in the focus of such a beam of light and signal back again to those manipulating the light by capping and uncapping his mirror, and his signals be entirely invisible to any watching eye. And no matter how his horse galloped, or what the angle of the mirror, the law of the angle of incidence and the angle of reflection would bring the reflected beam of light back again directly to its source. It is this feature of the apparatus which particularly recommends it for use on shipboard, where communication with sister ships or with the shore may be desired, in such a manner that no one may read the signals or even know of their existence Wireless signals may be caught and perhaps a code deciphered by any properly tuned apparatus, wig wags and Ardois light signals can be read by anyone who can see them, but the return beam of light from a triple mirror is so small in area and so faint to the eye, except it be in a direct line with it, as to be absolutely secret at all times

So accurately are these mirrors made of optically perfect glass, and so refined are the final polishings, that the variation in parallel between the sending and receiving beam of light is less than one foot in two miles Moreover, the returning beam of light is no larger than the surface diameter of the opening in the mirror—perhaps six inches—so that an observer standing three feet from a signalman cannot read signals returned from the triple mirror at two miles distance

In practice, the apparatus consists of a small portable searchlight with a magnesia button, which is heated to a white heat with a compressed oxy-acetylene or oxy-hydrogen jet This light is concentrated and reflected by a parabolic mirror With this apparatus, a radius of nine miles can be had with proper elevation; with an electric *searchlight* the triple mirror returns a "readable" beam eighteen miles in length At one side of the sending apparatus is a small telescope which is accurately in line with the focus of the parabolic reflector. Somewhere in the distance is a triple mirror; for the sake of illustration, let it be hung at the masthead of a battleship with the projection light apparatus in a fort on shore (Fig. 3). The beam of light is directed at the battleship. By the time it reaches three miles, it is so spread out and diffused—for it is not of great quantity—as to be completely lost to the eye not looking directly at the source. But some of the rays reach and impinge on the triple mirror at the masthead. No matter how the ship may pitch and toss with the waves, the light ray comes absolutely straight back again to the station on shore; a man with his eye to the telescope sees through it a brilliant white speck only. As a sailor on the masthead caps and uncaps the triple mirror, the brilliant white speck appears and disappears to the eye of the observer at the telescope—three feet to either side—and that bright speck is entirly invisible to any telescope or eye.

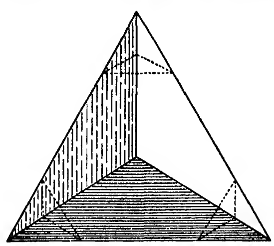


Fig. 1.—Shape of the triple mirror from the back. In use the pointed corners are cut off as indicated by the dotted lines.

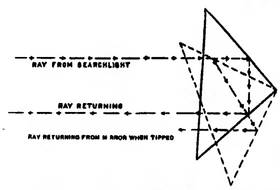


Fig. 2.—Courses of the searchlight rays with mirror tipped and untipped.

Now, it is conceivable that an enemy's battleship might cross between the two at the precise instant such signals were being sent, and that an observer on said battleship might be able to get to the exact point where he could perceive and read these signals, but it is highly improbable. As the circumference of a circle, the radius of which is three miles, is over eighteen miles, and as, at that distance, the diameter of the returning light ray is less than one half of one second of arc, there is not a very large space in which to locate and stand one's self to see an unknown signal.

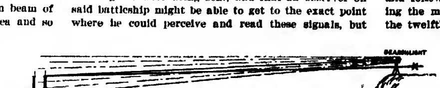


Fig. 3.—Returning beam, invisible to anyone not immediately in the path of the ray. Tossing of a ship has no effect on the destination of the ray. It always goes to the observer stationed at X.

If it is desired to have intercommunication equally as secret, the battleship would use *its* searchlight and the shore station *its* triple mirror. To the close observer, a ship and a station on shore would each be seen sending forth a motionless ray of light, with no signals passing. But in between and mixed up in these beams would be the smaller, weaker, but truly directed beam from the triple mirror, invisible to any save the eye which knew just where to look for them, and which, interrupted and allowed to proceed, would be sending in perfect silence and secrecy a message of dots and dashes which would not even have to be coded to be unreadable to the enemy.

The apparatus is easily used in broad daylight, in which case, of course, the sending beam is quite invisible, yet so bright is the reflection from the triple mirror, as seen through the telescope, that there is no difficulty in reading its message up to three miles distance. This apparatus is more portable than most land signaling devices, and being entirely independent of the sun, bids fair to take its place among the portable signaling apparatus of all armies, as well as in Germany, where the conception originated. A variation of a thousandth of an inch in the proper angle of the sides of the prism would send the return beam far afield of course; nothing short of accuracy so absolute as to allow but a foot or so variation in several miles would serve, and that degree of accuracy was finally, with difficulty, secured.

An interesting application of the apparatus is its attachment to balloons and aeroplanes, particularly the former. Carrying a searchlight of any power on a balloon is a hazardous undertaking because of the possibility of the heat igniting the gases from the envelope. But the triple mirror can be used to receive and return a light ray from the ground with no liability of danger whatever, and night observations reported to the home station even in the enemy's country without such signaling being seen at all from any one beneath the balloon. With even the most powerful searchlight, it is difficult to locate a balloon a mile high, and the small power light needed to send forth a returnable beam is of no use whatever to an enemy in locating a high balloon.

In fact, in any case where a signal station is desired where even a portable light generator may not be carried, the triple mirror gives excellent results. It is, in reality, a portable, heatless and almost weightless source of light, depending for its power on another source of light at a great distance.

Bacteria for Destroying Locusts

A BACTERIAL epidemic has within two years freed Yucatan of the locust swarms which periodically invaded the country. The malady lasts 12 to 46 hours and is characterized by a violent diarrhœa, the contents of the bowels of the insects yielding a nearly pure microbe culture. The microbe has been isolated by M. F. d'Hérelle, who in a memoir presented to the French Academy of Sciences, examines its specifical pathological effects.

Now, M. d'Hérelle having been asked by the Argentine government to test the effects of the same microbe on another locust species which every year devastates large portions of the Parana district, has reached surprisingly favorable results. As the virulence of the microbe had been weakened by a long series of laboratory cultures, it was at first reinforced by successive vaccinations on locusts. In the first series death was found to ensue after 36 to 60 hours, and in the tenth and following series after 6 to 8 hours. After isolating the microbe in gelose from the bowel contents of the twelfth series, M. d'Hérelle transmitted these cultures to broth which was used for infection. After 24 hours most of the 300-odd locusts kept in a cage and fed with infected lucern had died. After 5 days all the insects were dead, their bowel contents yielding a practically pure culture of the microbe.

Tests made on a large scale were quite as successful. One quart of culture liquid containing the microbe having been poured out on a field, a number of dead locusts were found after 5 days throughout the area of about 90 acres, and the insects continued to die on the following days, the epidemic even extending to the surroundings. The speed with which the malady was spread can be inferred from the fact that a few days after the first infection it occurred at a distance of 50 kilometers (31 miles) from the center of infection, having doubtless been transmitted by the winged locusts, which in Argentina are able in a single night to traverse a distance of 32 kilometers (20 miles).

As other locust species are likewise susceptible to the epidemic, it may be hoped that this will also in other countries afford an effective weapon in the struggle with the dreaded scourge.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Quimby Accident and Gyroscopic Force

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of August 10th and elsewhere, Earle L. Ovington has tried to lay the cause of the Quimby accident to a tangled control wire, instead of to the gyroscopic force of the Gnome motor. In presenting his evidence, however, he has conclusively proven to those who have studied the action of a gyroscope, the exact reverse of his claim, namely, that the tangled control could *not* have been the cause and that the machine acted exactly as this murderous and little understood force would make it act.

Let me quote:

"If you will examine my sketch you will see that by the wire catching as indicated, the rudder would be thrown to the left as it plunged downward. Does it not seem something more than mere coincidence that both Capt. Chase and myself agreed before we knew anything about this caught wire, that the aeroplane *turned to the left* as it fell?"

Take a gyroscope top. Set it rotating and hold it in front of you with the axis parallel to your line of vision so that it revolves clockwise as you look at it, the same as a Gnome motor when seen from the pilot's seat of a Blériot. Turn it sharply to the *left* trying to keep the axis horizontal. Note that the forward end of the axis dives *downward* in spite of you. Tilt it quickly up and note it swerves to the left. Repeat these experiments many times and note that the quicker your turn the more powerful the swerve.

Mr. Ovington admits the presence of gyroscopic force in a revolving motor but asserts it is "negligible" because the plane of rotation is not changed rapidly enough. Let us see:

The Seguin brothers, builders of the Gnome, in an experiment reported in *Aero* (American) of June 15th, 1912, have shown there is 57.6 pounds of gyroscopic force in a 50 horse-power Gnome in a 12-second turn when mounted on a pivoted platform and revolving at 1,200 revolutions per minute. Mr. Thomas Preston Brooke, who first drew attention to the dangers of this force has proved that in a case of this kind the supporting platform receives approximately 80 per cent of the gyro strain. Therefore the Seguin figures represent about 20 per cent of the amount of force that would be present in the same engine if it were floating in air unsupported. However we will consider their figures as given. According to Albert Kapetyn (see English *Flight*, November 19th, 1910), and M. Bouchard Praceig of Society of Engineers of Paris (see *La Nature* of March 4th, 1911) the amount of this force increases as the square of the speed of the turn.

If there is 57.6 pounds of gyroscopic force in a 12-second turn there is 12 times as much or 691 pounds of it in a 1-second turn and 1,382 pounds in a half-second turn. Remember that a complete turn is not necessary but that a change in the path of flight of 1 degree at the speed of a complete turn in 1 second arouses the same force as a 360-degree turn, the speed being constant.

I quote again:

"As the tail of the machine went up and to the right, Willard was thrown out 25 or 35 feet as a hundred witnesses will testify."

Does anybody with common sense believe it took the tail of that machine 12 seconds to make a dive that would throw a man's body 25 or 30 feet? Is it not a practical certainty that it happened in fractions of a second?

Ovington says it is not dangerous because the plane of rotation is not changed quickly enough. Certainly the turns are not quick enough, ninety-nine times out of a hundred. Nobody disputes that. But why ignore the hundredth time when the turn *is* quick enough and the force is too strong for the controls and another of our birdmen dives to his needless death?

Ovington failed to understand the significance of the main features of the accident. In the first place a number of eye witnesses, himself included, state positively that after Willard had been thrown out, Miss Quimby succeeded in righting the machine but only for an instant, when it was again whirled nose downward and dove in a straight line for the water. Now if the fouled rudder cable caused the dive, as he claims, how could she have righted the machine? Then again with the rudder jammed to the left how could the machine have sailed *straight down* and avoided a series of spirals? It does not seem just clear? Does it?

If Mr. Ovington is an engineer he should have particularly noted several important points. He says Willard was thrown into the air 25 or 35 feet as though shot from a catapult. He also says the dip was caused by the controls. Therefore, if he possesses the rudiments of engineering knowledge he should know that the aeroplane would then turn about its center of gravity or lateral axis. As the passenger seat occupied by Willard was not more than 3 feet back of this axis, there could not possibly have been sufficient angular movement at this point to throw him out as described. I am confident that every competent engineer will bear me out in this statement.

These conditions of the accident completely disprove Mr. Ovington's theory.

On the other hand if, as I claim, the accident was caused by gyroscopic force in the motor, the entire machine would then turn about the center of effort of the motor which would be its exact center of gravity. Thus we see that the motor being the fulcrum of the lever, Willard would be 7 or 8 feet from the center of effort and in a quick dive it would not be impossible to throw him the 35 feet. Suppose that a slight wind gust caused a sudden dip in the front of the machine. A very slight, quick movement would have been sufficient to have aroused the gyroscopic force. Miss Quimby would naturally attempt to correct the equilibrium by raising her elevator, thereby accelerating the precession of the gyroscope and causing it to twist the machine to the left and downward. The severity of the twisting motion would be entirely dependent upon the speed of the previous motion that aroused it and judging from the terrific force exhibited I should say this must have been so quick that no human eye, one thousand feet below on the ground, could have detected it.

With this explanation it is easy to see how Willard could have been thrown that distance straight out from his seat, and, also, if one is familiar with the tremendous gyrating power of this force why the machine seemed to right itself.

Mr. Ovington went to great trouble to get affidavits supporting his claim about the machine swerving to the left. If he had read more carefully the articles of the several scientists who have warned against this peril, and particularly if he had ever studied the action of a gyroscope he would have known that under these conditions the machine always *swerves to the left* as it falls.

Chicago, Ill. RALPH M. PEARSON.

Wanted: Research on Gyroscopic Action

To the Editor of the SCIENTIFIC AMERICAN:

I notice that there has been some discussion in the SCIENTIFIC AMERICAN regarding the gyroscopic action of the rotating parts of flying machines. The Gnome is, without doubt, the most popular engine that we have to-day. This engine is of considerable weight and practically the whole of it revolves at a high speed in the same direction as the screw or propeller. There is no question about it, these high rotating parts do produce a very powerful gyroscopic action.

Some years ago there was a red hot discussion in England regarding the sinking of the torpedo-boat destroyer "Cobra." When I pointed out that there was no gyroscopic action, everyone imagined that I had "got my foot into it," as they said, but experiments showed that I was right after all.

I am sending you inclosed a cutting from the *Daily Mail*, which I think will serve to show the effect of a Gnome engine on a flying machine.

I am very strongly of the opinion that some experiments ought to be made to show the character and force of the strains that are set up when the machine is flying other than in a straight line. The experiments can be made at very little expense. All that is necessary would be to erect a rotating platform, rotating after the manner of a table lathe, that is, on a vertical axis. The engine and propeller would be mounted on this platform, not rigidly, but on what might be called trunnions perpendicular to the vertical axis. The machine should be so mounted that it could move freely on these trunnions, say thirty degrees in either direction. The trunnions should be as near the center of gravity as possible and the machine held in a horizontal position by spiral springs. If now we cause the motor to run at full speed and rotate the platform on its vertical axis, we shall find that the machine has a strong tendency to move on the horizontal axis, and it would be a very easy matter with a spring balance to find out how much it would require to hold the machine in a horizontal position while it is being slowly rotated on its vertical axis.

If someone would make these experiments in the States and they should be published in the SCIENTIFIC AMERICAN it would be of great value to everyone who is interested in the development of flying machines.

London, England. HIRAM S. MAXIM.

[The suggestion of Sir Hiram should be followed by one of the well-equipped technical laboratories of which we have so many in the United States. No one questions that gyroscopic force is developed when an aeroplane, driven by a single revolving-motor engine, makes a turn. The only question is as to the amount of this force. A practical demonstration along the lines suggested in this letter would provide exact data.—EDITOR.]

Lack of Aviation Enthusiasm

To the Editor of the SCIENTIFIC AMERICAN.

The undersigned wishes to make the following comments with reference to an editorial which appeared in the issue of September 21st of the SCIENTIFIC AMERICAN. The subject of this editorial was the lack of enthusiasm displayed in the United States in the progress of aviation, which showed itself glaringly in the failure of America to send a single machine across the line in defense of the Gordon Bennett Cup. In addition to the comments made by Mr. Charles A. Manley on September 28th, the undersigned wishes to offer the following suggestions.

The strongest motive which urges on the French people to perfect aviation to the highest degree attainable, regardless of cost, is their strategic relation toward Germany. To them the aeroplane naturally appears as an excellent weapon with which to establish a superiority over Germany, and great hopes are set upon this means of attack and defense. This of course forces Germany to follow suit and on its part to develop its aeronautic force to the highest possible degree. And the other European countries follow the example of France and Germany because they also have to reckon with the possibility of war, and the new weapon appears to them also as a very valuable means of carrying on warfare. Inasmuch as the United States are in the fortunate position of having no such powerful and hostile neighbors, but having on their borders only comparatively insignificant or else friendly nations, they have no occasion to pay the same attention to the new arm of war as is devoted to it by European nations.

In addition to the circumstances just referred to, there is another important factor bearing on the situation, namely, that in spite of all the improvements of the aeroplane of to-day, it nevertheless remains an unsafe mode of locomotion, and there seems to be no possibility of entirely overcoming this defect. Furthermore, the time of flight must necessarily always remain limited and can probably not be much extended beyond its present value.

The cause of these two defects must be traced to the necessity of using powerful motors and propellers. The consequence is that aeroplane flight has not become very general and has remained unpopular. In Europe, especially in France and Germany, the competitive efforts to improve aviation represent a kind of warfare, in which the lives lost are counted among the inevitable cost of war.

In a peaceful country, such as the United States, the causes which impel the European nations to competition in attaining the highest perfection in aviation are entirely lacking. If the military inducements did not exist in Europe, probably there would be even less progress there than in America. There is no lack of enthusiasm for the cause here, but the only system of aviation which can find extended application and success in this country is one which guarantees greater safety for the life of the passenger and a longer duration of flight, a system which, therefore, is better adapted for practical purposes and for sport. F. BIBERSTEIN.

Milwaukee, Wis.

[There is a great deal of sound reason in Mr Biberstein's comment At the same time we fear that he is a little too lenient to us as a nation in this matter. For the flights of the "Schwaben," representing, as they do, at least a semi-commercial undertaking, and the general interest which has been shown in them by the German people, prove clearly enough, that in Germany at any rate interest in aviation, however much it may be fostered by strategic consideration, has also a strong practical basis quite apart from its military *raison d'être*—EDITOR.]

The Current Supplement

THE current issue of our SUPPLEMENT contains a number of articles which will be found of special interest "Safety First" is the cry raised by R. C. Richards in dealing with the burning question of the Prevention of Railroad Accidents.—Mr R D. Andrews discusses some very remarkable properties of aeroplane-pairs arranged in tandem.—The problem of internal-combustion locomotives is one which is likely to receive increasing attention in the future, and is briefly dealt with in this issue.—An excellent review of recent progress in illumination, representing the report of a special committee appointed by the Illuminating Engineering Society, should prove of interest not only to engineers but to the general reader also.—Mr. C. A. Tupper describes a remarkable sixty thousand horse-power blast furnace gas engine plant.—We had occasion some time ago to give a preliminary report of Sir J. J. Thomson's new method of chemical analysis, in which the molecules are literally "weighed."—A most excellent detailed account of these experiments is now given by Mr. F. W. Aston of the Cavendish Laboratory, Cambridge, England.—The Fire Department of the French capital has recently been completely reorganized, the automobile equipment being brought up to the latest pattern. These innovations are described in a well-illustrated article.

Fig. 1.—View of the Jambon-Bailly studio in Paris.

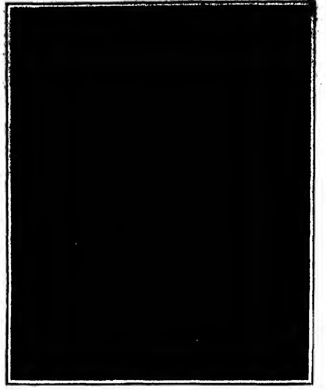


Fig. 2.—The "pallette," in which the hues are prepared.

A Glimpse of a Scenic Painter's Studio

A Profession That Calls for an Intimate Acquaintance With Historic Conditions

By Dr. Alfred Gradenwitz

THE art of scene painting is one of the most interesting and at the same time exacting professions. It demands of its adepts, apart from their professional skill, a vast all-round education and knowledge of the most varied description. A scenic painter ought, in fact, to be well acquainted with the history of styles, dress, furniture, armor, etc., all of which should appeal to him as strongly as architecture proper. He should have an accurate idea of the habits of any epoch and the customs of any nation. Among his records, in his own professional library, should be included the very principle of the various forms of architecture, sculpture, painting, etc. In the case of modern landscape he should not be at a loss to choose the right scenery and, if necessary, go abroad to find on the ground the inspiration required for his work. The real artist among scene painters, of course, always records his impressions in a sketch book which in course of time will form a real storehouse of valuable scenery elements. Visits to the foremost museums of the world as well as a keen observation of nature and men will be required to develop his taste and to form the material on which his imagination may draw at the right moment. In fact, the ideal scene painter has to comply with more numerous and varied requirements than most persons engaged in other walks of life.

One of the most difficult tasks, previous to the design of a given set of scenery, is to read intelligently the author's manuscript. Many will be inclined to think that if a scene takes place in our day there will be no need for such imagination, in order to paint a village, a country road and cottage, a drawing room, plain or fashionable, etc. This is true enough if the painter be content with turning out such indifferent work as can be seen in most second-class theaters. The real artist, however, remembering that scenery often is a decisive factor in the success or failure of a piece, will go through the manuscript most carefully, taking notes every now and then and making the actors play in the scenery imagined by himself. Many minor details entailed by the dramatic action will have to be thought out in this connection. The execution of this work may be carried out best in a studio like that shown in Fig. 1.

Fig. 3.—Studying the details of a scenic setting at the Jambon-Bailly studio.

Fig. 4.—The draftsman or "tracer" marking the design upon a canvas.

After reading the manuscript, the scene painter first draws a rough sketch, fixing the "principles" of the scenery, with the pencil, pen, carbon, or crayon, but preferably with water colors and brush, thus allowing his imagination a wider scope. Much skill is required to produce even this first sketch, so that the painter may effectually defend his plans in discussion with the director and the author, both of whom have, of course, their own ways of looking at the matter. This sketch, which often is completed in an hour or so, will be used in producing a small sized model or "maquette," a miniature stage—similar to those put together by children with cut-out paper and wood—which is so designed as to give an adequate idea of the scenery to be produced. Any details are shown in the form of small pieces of cardboard cut out and fixed on a horizontal cardboard reproducing the floor of the stage. This is how any trees, houses, rocks, in fact, the whole of the scenery, are reproduced in a diminutive compass, inside a box opened in front and on the top, so as to insure adequate lighting effects (Fig. 3).

On this miniature stage the artist arranges his scenery. Here he sees on a reduced scale where the various parts of his work should be placed. He is in a position adequately to judge of effects, adding and cutting down, and altering any inconvenient arrangement. A "maquette," like a painting, should be the artist's personal work. Its successful design reveals the capacities of its author, and a poor "maquette" often foretells failure of the whole scenery. A good stage model of this kind, which may be a master-piece in itself, is most useful in arranging with the author and director any minor alterations that the case may require; the scales generally chosen are 3, 4, and sometimes 5 in 100. It is a welcome means for the painter to test his light effects, to ascertain the height of the ceilings and to check the perspective. In order to prevent any disagreement between the dimensions of the scenery and those of the actors, the foreground should always be painted in real dimensions.

About a hundred years ago the general practice was to trace the outlines of a

canvas on the ground, but to complete it standing up, in the position it was to occupy on the stage. Extensive walls as well as a complicated system of scaffolding therefore were required to paint the scenery.

While this practice is still followed in England and in some studios in this country, painting on the ground, a much more rapid process, has been found preferable nearly everywhere else.

In order, however, to enable the painter to work easily and without much bending over the canvas lying on the ground, all sorts of utensils fitted to the ends of long sticks are used. These utensils are the "brooms" and "brushes," the "ruler" and the carbon-holder.

The "brooms" are merely big painting brushes, round or square, such as those used by decorators, and are handled in an upright position. They serve to apply to the canvas the first general layers and are handled alternately from right to left, and left to right, with the two hands placed above each other, by long sticks kept vertically to the ground, so as to allow the paint to be laid on more vigorously. Taking up a considerable amount of paint, these brushes allow a large portion of the canvas to be painted most rapidly.

The "brushes" are painting brushes of variable thickness, used especially in painting the details of the picture; they are handled with one hand, the same as the long carbon-holder, used to trace a sketch in proper dimensions.

The draftsman, who by means of this carbon-holder and the long ruler with its stick, transfers to the canvas all the measures and profiles of the "maquette" (Fig. 4) is in French studios called "tracer" (*traceur*).

The "palette" (Fig. 2) is a sort of large box in which hues, taken from earthenware pots containing liquids of all colors, are prepared for laying on.

In tracing circles of large diameter, a pencil attached to the end of a string is used; for smaller circles large wooden compasses are employed. Of other tools invented by the ingenuity of scenic painters should be mentioned a sort of square box supported on two uprights connected by a horizontal handle, for use in transporting the color pots from one point on the canvas to another. Other utensils of the scenic painter are: the "duster," a long stick carrying at its end some strips of cloth, which is used in blotting out the carbon outlines and any errors made in tracing; a long wooden ruler carrying at one end a sharp point and at the other end an adjustable pencil, which also serves to trace, though in a much more perfect manner, any circles of large diameter, and, finally, a big square, 3½ meters in maximum length.

Oil painting is never used by the scenic painter. Apart from their prohibitive cost, oil colors would, in fact, make the scenery too heavy, and would dry much too slowly to allow the painter to walk on the canvas. Moreover, oil painting, on account of its brilliant reflexes, would be disagreeable to the eye. Nor does the scenic painter use benzine or varnish.

His colors are of a special kind, dispatched in barrels in the form of powders or pastes of all the hues of the palette. Powdered colors are dissolved in water and agglutinated by means of heated glue. Color pastes are more brilliant, but are apt to congeal at low temperatures. As soon as the color is prepared, it is poured into pots. Whenever large surfaces are to be covered, e. g., in preparing the priming, whole buckets of paint are poured out on the canvas by means of the very largest brushes. On drying, the glue fixes the color on the canvas. By varying the amount of water and glue, colors of any desired thickness can be obtained; a special advantage of these colors is their remarkable ease of handling and the minimal resistance they oppose to the brush.

Before using the canvas, the tracer, in order to facilitate his work, makes a drawing on paper in real dimensions, which is pounced on the canvas (Fig. 5). Some of the tracers are remarkably skilled and are most interesting to watch in touching up with the ends of their carbon-holders the curvature of a volute, or in designing a decoration, etc. They also mark with chalk those points where light effects should be obtained. Their task finally comprises the designing of the perspective, which in the case, for instance, of a complicated masonry is by no means easy. They go to and fro over the canvas with their slippers on, and seem even more at ease in drawing in their upright position than if they were seated at a table. The skill they acquire by practice is wonderful and it enables them to achieve real marvels. Tracers, like painters, should have a good knowledge of styles. Carelessness in their work is only too often responsible for failure of the whole painting, while nothing facilitates so much the painter's task as a satisfactory tracing.

After stretching the canvas out on the ground and fixing it by means of drawing pins, the first thing to do is to coat it with a white priming. When this is dried, the tracers transfer on the canvas all the different measures and profiles of the "maquette," using a special ink in marking any characteristic details. Only after the tracer's work is done and a framework of outlines obtained on the canvas, does the painter's task begin. He first applies, as on an oil painting, the fundamental layers reproducing the general outlines of the picture, always remembering that the colors thus used freely will lose much of their intensity in drying.

Any details are then brought out with the finer brushes, which on account of the size of the panel and its position on the ground is by no means an easy task. In connection with architectural interiors, some details of decoration have sometimes to be accentuated by means of a

(*Concluded on page 355.*)


Fig. 5.—A theater curtain design, to be transferred to the canvas.


Fig. 6.—Joiner cutting the curved outlines of scenery frames.

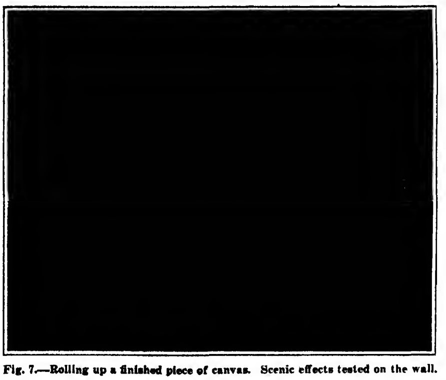


Fig. 7.—Rolling up a finished piece of canvas. Scenic effects tested on the wall.

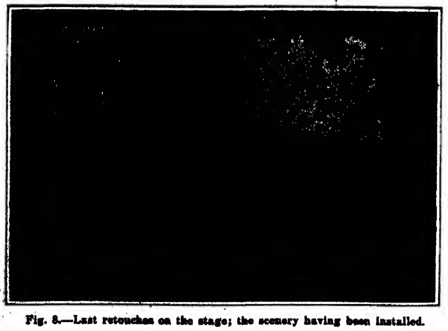


Fig. 8.—Last retouches on the stage; the scenery having been installed.

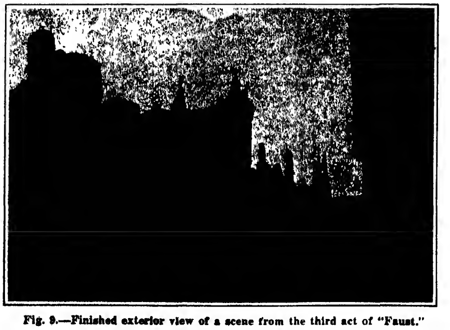


Fig. 9.—Finished exterior view of a scene from the third act of "Faust."

The Twin-screw Motor Vessel "Monte Penedo"

By Our Berlin Correspondent

THE twin-screw motor vessel, "Monte Penedo," recently built by Messrs. Howaldtswerke of Kiel to the order of the Hamburg-South American Steamship Company, in so far represents a most interesting new type of vessel as it is the first large transatlantic freight ship to be equipped with two-cycle Diesel motors.

The "Monte Penedo" is 350 feet in length, 50 feet in breadth and 27 feet in depth, her gross tonnage being about 4,000 registered tons and her carrying capacity about 6,500 tons. She has two continuous steel decks, a long poop and forecastle, a continuous double bottom and an elevated ballast tank, four holds, 6 watertight transversal bulkheads and two masts, and comprises the most up-to-date loading and unloading devices for the handling of goods up to 35 tons in individual weight. The dwelling rooms for the captain and officers are arranged amidships, and those for the machinists at the rear on the poop deck, whereas the sailors are accommodated below the fo'castle and the engineers below the poop.

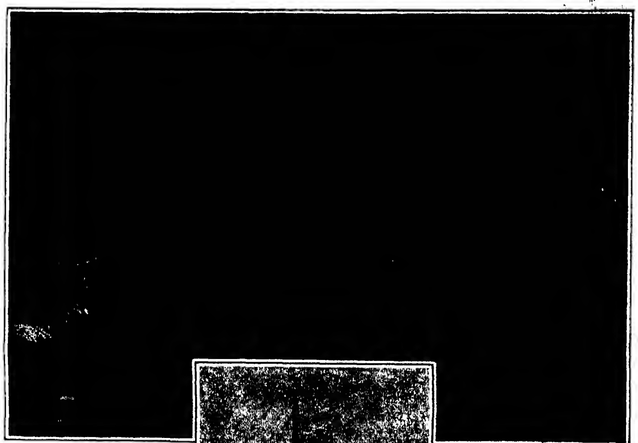
The "Monte Penedo" is operated by two reversible, four-cylinder, two-cycle, Diesel-Sulzer crude oil motors of a total output of 2,000 indicated horse-power, which drive the vessel, at full load, at a speed of about 10½ knots. The auxiliary machinery comprises a 50 horse-power Diesel dynamo, a 50 horse-power compressor, an auxiliary steam-operated compressor, an auxiliary condensing plant, and a condensed water re-cooling plant. Most of the auxiliary machinery is operated by steam generated by an oil-fired auxiliary boiler. The steering gear is actuated by pre-heated compressed air. The oil bunkers are protected by special safety devices against any risk of fire, as well as against injury and leakage in the event of collision, so that all requirements with regard to the safety of the vessel are fully complied with.

The Sulzer two-cycle motor installed on the "Monte Penedo" show some important advantages over the four-cycle motors of the recently-built motor vessels "Selandia" and "Christian X." They are, in fact, considerably smaller and lighter with an equal oil consumption, and as their space requirements are less, the space and weight left for the installation of the cargo are considerably greater. Moreover, two-cycle motors are cheaper and simpler in design, so that the cost of repair is lower. It is claimed that there is a certain advantage in two-cycle motors over four-cycle motors because of their superior maneuvering capacities.

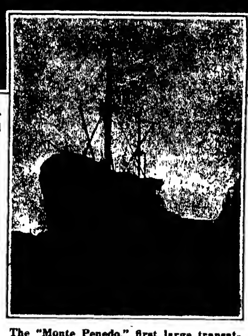
In order to give an idea of the advantages to be expected from the adoption of such motors, it may be said that the saving in fuel as compared with quadruple expansion engines during a voyage of 13,500 nautical miles from Hamburg to Buenos Aires, will be 1,073 tons, and on the home voyage 537 tons, i. e., an average of 805 tons, while the saving as compared with triple-expansion engines is 1,323 and 662 tons, respectively, the average being 993 tons. When adding this to the saving in weight due to the smaller weight of Diesel-Sulzer motors, the total saving or surplus capacity works out as follows: As compared with quadruple-expansion engines, a surplus capacity of 975 tons, i. e., about 15 per cent, and as compared with triple-expansion engines, a surplus capacity of 1,163 tons, or 18 per cent.

During the recent trial trip a speed of 13.8 knots was obtained.

The "Monte Penedo" has just started on her maiden voyage to South America.



Upper platform in the engine room, showing the valve mechanism of the two-cycle Diesel motors of 2,000 horse-power.



The "Monte Penedo," first large transatlantic freighter driven by two-cycle motors.

Tokio Buys Motor Fire Engines.—The Japanese capital has just installed eleven motor fire engines, in an attempt to reduce the terrible annual loss by fire in that city. The cars are driven by gasoline, while the pumps are worked by steam.

The Improvement of Fifth Avenue

FIFTH AVENUE, New York, is a street of national interest. It is the most exclusive shopping street of the nation's largest city, lined with the highest priced shops displaying signs of famous foreign houses. In spite of many fine buildings, the avenue, outwardly, falls short in many ways of its business reputation. Many of the stores are modified brown stone dwellings.

The recent widening of the roadway of Fifth Avenue from forty to fifty-five feet, and the wholesale removal from the sidewalks of building encroachments, have greatly increased the traffic capacity of the avenue. Four lines of vehicles can now move along instead of two or three. Recently a municipal commission has recommended still more improvements, which are on the eve of being carried out, viz., further widening of the roadway, redesigning of squares, tree planting where possible, better lighting, isles of safety, public cab stands, limitation of the height of buildings, and reduction of sidewalk congestion.

There is one side to Fifth Avenue of which no marked improvement has yet been attempted. That is the engineering side. True, the asphalt pavement is now laid on a concrete base, and every effort is being made to get the surface durable and free from defects. The street is very smooth in the main, and is kept well cleaned. The chief defects are those due to past practice. The question is: Would it be worth while to remedy them?

The most noticeable shortcoming inherited by Fifth Avenue from the past is in its surface drainage. The street has very little slope from the center to the gutters, and the gutters have very little slope toward the catch basins; with the result that little pools of water remain after rains, and even for some time after sprinkling. These pools, though injurious to the asphalt, are not objectionable to the public except when they occur at street crossings, which is very often the case, owing to the lack of slope of the street.

During a rain storm the defective drainage is most apparent. At such a time streams of water are often encountered in crossing the street, although the best highway practice requires that no water should flow past a street crossing. A study of the location and frequency of catch basins along Fifth Avenue shows why so much water is seen. Comparatively few catch basins are found, and these are almost always located on the street corners, where the water to reach them must pass two crosswalks. This old custom has the further objection of causing the curb to be highest where it is most used. It is considered the best practice at a street junction to have the highest point of the gutter exactly at the street corner, the water flowing down each street to two catch basins close by. If Fifth Avenue were constructed to-day along modern lines, there would be one hundred and sixty catch basins to a mile, or eight at every street intersection. Instead, there are only from eighteen to thirty found per mile.

Again, the gutter-mouths leading into the catch basins are often small, and the gratings much clogged with street sweepings. Sometimes the street surface slopes the wrong way, so that water flows by a basin and by a cross street. Instead of having basins every 200 feet, which is considered desirable in the built-up sections of some cities, as long a distance as 1,600 feet has been found without a catch basin. Moreover, there are no catch basins on the cross streets, though these are 800 feet long, west of the avenue. Still another place where water lingers is in the covers of certain catch basins on the sidewalks, and certain manhole covers in the street, owing to recesses in the covers.

The final question is whether it is worth while to reconstruct city streets according to modern standards. Against doing so is the cost, involving in the case of Fifth Avenue the raising of the level of the street center, changing gutter grades, building all new catch basins, in new locations, etc. On the other hand, reconstruction of everything in a city is necessary with some frequency. Should not an avenue of the importance of Fifth Avenue be kept up more nearly to modern standards? The traffic will increase more and more, making radical alterations more difficult in the future. The desirable thing would seem to be to begin the reconstruction of the avenue, half the width and one block at a time. Pipe galleries should be introduced under each side of the street, as is done with new streets in London. Manholes should be located so as not to be in the way of travel when they have to be opened. Iron covers should be banished, and non-slipping covers adopted which will not hold water.

Such changes should not be regarded as unnecessary refinements. It is necessary in private business to keep adopting new methods and new equipment. Why not in the public business as well? Some American cities are doing this, but too often it is along only a few lines. Every municipal department should be encouraged to study out improvements, and ideas should be exchanged even more than now with other cities.

Non-astringent Persimmons

THE popular demand for the large and beautiful Japanese persimmon has been retarded by the marked astringency of the fruit when firm and tempting to the eye. Moreover, if the fruit is allowed to ripen until the "pucker" is lost it becomes soft and mushy, decaying very rapidly. In Japan they have for years practiced the art of removing the "pucker" by sealing the firm fruit in barrels which have been rinsed with "sake," a sort of Japanese beer. Our Bureau of Chemistry finally took the hint and have recently found that the same effect is obtained by keeping the persimmon in carbon dioxide from three to five days. Some varieties come out of this "processing," as it is called, as firm as an apple and may be peeled and eaten like an apple with great satisfaction. Our native American persimmon, however, does not respond to this treatment. The fruit grows easily on the Gulf coast, and the demand is increasing. When the growers and retail dealers learn that persimmons may be put on the market in firm, rosy and edible condition the industry will take on new life.

An Electric Stove

By Frederick E. Ward

THE convenience and utility of electric heating apparatus have so long been recognized that were it not for the high cost of electric energy, as compared with coal and gas, hardly any housewife could now be persuaded to cook with any other than an electric stove. But even if it does cost a little more for power, many of us are glad to use it occasionally merely because of its convenience. For those who have electric current in their homes and would like to make such occasional use of it, and yet who are discouraged from so doing by the rather high cost of an electric stove, the following description shows how one of these can

Fig. 1.—The stove complete.

be made at home at a cost for materials of but a fraction of the regular price of the commercial article.

An electric stove is a very simple and efficient piece of apparatus. It is practically nothing but a piece of wire which is heated red hot by the passage of the current through it, and it is easily made because success depends more on the selection of proper materials than on skillful workmanship.

As shown in the photograph in Fig. 1, the body of the stove consists of a fireproof box about seven inches square and three inches high. This may be built up of four pieces of asbestos board, about ⅛ inch thick, fastened together by corner pieces bent up from sheet copper or brass held in place by small brass machine screws and nuts. Asbestos shingles also serve the purpose well, and these are cheap and easily obtained from dealers in builder's materials.

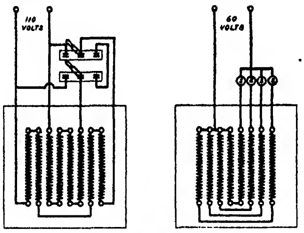


Fig. 2.—Diagrams of connections.

The essential part of the apparatus is, of course, the heating element, shown more clearly in the photograph in Fig. 3. The base of the heater is a square of the asbestos board cut to fit inside the box, and having four strips of the same material riveted to it so as to form a sort of picture frame four inches square inside. Across this frame are stretched the eight pieces of wire which form the heating element itself.

Of the many different makes of wire on the market one of the best is the "Nichrome," made by the Driver-Harris Wire Company, of Harrison, New Jersey. The heater shown in the photographs was made of gage number 22 Nichrome wire, which has a resistance of about one ohm per foot. The weight of wire actually used in this stove was only 1¼ ounces, but it is advisable to order at least one half pound of the wire, as wire-drawing companies do not, as a rule, care to book orders amounting to less than one dollar.

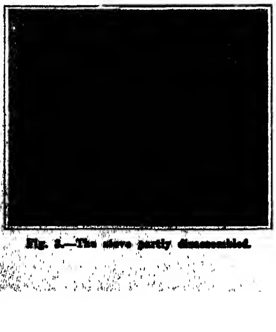


Fig. 3.—The stove partly disassembled.

The eight helices for the heater are each formed by winding 135 turns of the wire closely around a rod just one eighth of an inch in diameter, on which the turns will cover a length of 3⅝ inches. The rod is then removed and the ends of the wire bent up into eyes, by means of which, after a slight stretching, they may be attached to the asbestos frame by small brass machine screws fitted with nuts and washers. If each screw be provided with two nuts on the back the electrical connections are very conveniently made by clamping pieces of No. 16 copper wire between the nuts.

Diagrams of connections are shown in Fig. 2. For 110 volts the arrangement shown provides three different heats, two double-throw single-pole switches being employed. When both blades are closed to the left the heater develops full heat, and consumes about 880 watts. Opening either switch reduces this to one half, and closing both blades to the right gives one quarter heat. For 60 volt isolated plants another scheme of connections is shown, in which the heater is divided into four sections, each under the separate control of its own snap switch.

The heating element is best supported in the box by means of strips of asbestos board riveted on the inside. The wires must be low enough down so that metallic cooking utensils cannot touch them and cause a short circuit. If the cooking utensils to be used are too small to cover the entire top of the box it is essential to provide a top piece of asbestos board, as shown in Fig. 1, to cover the open corners and prevent waste of heat.

To make the stove ready for use as a radiant toaster, it is sufficient to cover the top with a square of coarse wire cloth upon which to lay the slices of bread.

Studying Prismatic Colors of Incandescent Lamps with a Reading Glass

By Stuart K. Harlow

THE following interesting investigation of the different colors of the spectrum of the filaments of the tungsten and carbon incandescent lamps was carried out with a 2¼-inch diameter magnifying glass.

The first lamp tested was a 40-watt Mazda lamp, suspended from the ceiling in a white corrugated china shade. The reading glass was held horizontally below the lamp and at a distance of 12 to 16 inches, with a 12 by 12-inch square sheet of white enameled paper held parallel to the reading glass and at the proper focal distance from the lens. The superior color was found to be white, which was fringed with yellow, orange, red, green, blue, and violet. All these colors do no appear in the scene at one position of the lens, because the principal focal distances in the double convex lens are different for different colors, being less for violet than for red. This phenomenon is known as chromatic aberration. It is eliminated in our particular experiment by moving the hand lens back and forth, thus varying the focal distance. By holding the lens at an angle to the incandescent lamp, the illuminated filament appears inclosed in its bulb and shade.

The next lamp tested was a 16 candle-power 50-watt carbon filament incandescent. The lens was held in the same position as above; the filament appears as a broad incandescent band, in which yellow, together with white are the superior colors, red being present to a greater degree than it is in the tungsten lamp. This incandescent band was fringed with orange, red, green, blue, and violet.

A kerosene oil hand lamp with wick and the ordinary glass chimney, when the lens is held parallel to the flame and at a distance of 3 feet, its spectrum appears as yellow with slight traces of white, and orange, red, and green around the edges. When the lens is held at a distance of 12 feet from the illuminant, the spectrum appears as a small circle three-sixteenths in diameter, the center of which is brown, but still showing traces of red, orange, yellow, green, and blue.

It might be interesting in this article to mention an observation of the New York Testing Laboratories exhibit at the 1909 Chicago Electrical Show at the Coliseum. It consisted of three projection machines mounted with suitable lenses to project the arc spectrum of the flaming arc, magnetite arc, and carbon arc on a canvas screen a few feet away. The image of the flaming arc showed yellow, orange, red, blue, and purple; magnetite arc, white, yellow, and blue; and the carbon arc, green, yellow, orange, and purple. The carbon arc appeared thin and dim on the canvas screen.

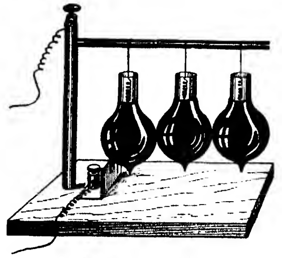
Leyden Jars Made of Incandescent Lamp Bulbs

By Maxwell Epstein

TO give best results, a Leyden jar must have a good dielectric with little thickness. Ordinary burnt-out incandescent lamps—16 candle-power or larger—can easily be converted into excellent Leyden jars. The best bulbs can be selected by rubbing with silk in a dark room. Those that glow most make the best jars.

A slit is cut across the threaded metal top with a hack saw, and the thin brass is peeled off with a pair of pliers. The leading-in wires can now be easily cut, the top taken off, and the bulb cleansed of the insulating compound. The groove at the junction of the in-going glass tube and the bulb, is scratched with the sharp point of a broken file moistened with turpentine, until the tube with the filament can be pulled out.

The bulb is now coated outside with tinfoil to within 1½ inches of the top, and filled inside to the same height with scraps of tinfoil. A piece of No. 20 B. & S. copper wire, hooked at one end, is thrust



A battery of Leyden jars.

through a half inch cardboard disk and into the bulb. The top is now sealed with sealing wax.

The amalgam used for coating mirrors is preferred to the tinfoil inside, if it can be obtained or made as described in the SCIENTIFIC AMERICAN of April 8th, 1911.

By hooking these jars on a brass rod and pushing them together, as shown in the figure, excellent variation in capacity can be secured for the closed circuit of a wireless transmitter.

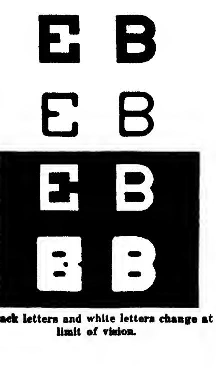
Relative Clearness of White and Black Letters

By Samuel W. Balch

THERE is a general tendency on the part of railroads to adopt signs with white letters on a black background, not realizing that the black letter on a white background is easier to read and can be seen at a greater distance. This follows in an interesting way from the structure of the retina of the eye. The impression of a letter at the limit of vision is received on the ends of a small bundle of nerves which convey to the brain a sort of mosaic impression.

A nerve can only transmit to the brain information as to whether or not a ray of light is falling upon it and when a nerve is partly in the light and partly in darkness the sensation is the same as though all of it was in the light. It follows, therefore, that all nerves on the dividing edge between any black and white area transmit the sensation of light so that all white lines and white areas appear wider and all black lines and black areas appear narrower than they really are.

The two black letters in the illustration grow thinner at the limit of vision and are still recognizable, while at the same distance the two white letters grow thicker and cannot be distinguished. There are circumstances when it is necessary to use white letters, but in such cases legibility will be improved if they are made with a thin stroke and strongly lighted. Black letters are more distinct if made with a heavy stroke.



How black letters and white letters change at the limit of vision.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Notes for Inventors

A Toy Puzzle.—In a patent, No. 1,038,-190, Waldemar J. P. Olsen of Brooklyn, N. Y., presents a patent in the form of an egg-shape shell within which is a tilting plate and a weight is movable on the plate and operates in connection with small balls to secure a balancing of the shell under certain conditions.

Cork Articles from Granulated Cork.—In patent No. 1,035,146 Louis L. Bentley of Beaver Falls, Pa., assignor to Armstrong Cork Company, of Pittsburgh, presents a method in which granulated cork is pre-heated to a temperature below the melting point of the cork resin and is then fed while hot into molds. Pressure is applied to the cork in the molds and the cork is baked while under pressure high enough to melt the resin. This resin as it cools cements the granules together.

Increases Butter Yield from Milk.—A Hamburg, Germany, man, Adolf Wilhelm Karl Witte, in a patent, No. 1,039,627, describes a process of treating milk and cream to secure an increased yield in butter and in which he cools the material to a temperature somewhat above freezing point and maintains it at such temperature for about twenty-four hours and then quickly warms it to a temperature of 18 to 20 deg. Cent., adds a souring generator or "starter" and immediately churns the material when it is ripe.

Utilizing Moving Pictures in Target Practice.—We are constantly learning of new uses for moving pictures. Now James Paterson of London, Eng., in patent No. 1,035,811 provides a target divided into recessed sections with means in each section for completing, by contact, electric circuits, and moves the target behind the picture screen, synchronously with the object to be fired at. An indicator is arranged at the firing point and is operated electrically from the target so that as a shot is fired it can be determined instantly whether a hit has been made.

A Machine for Making Bale-tie Buckles.—Ezra A. Frantz of Weatherford, Texas, assignor to Frantz Buckle Company of that place, has secured a patent, No. 1,034,007, for a machine for making bale-tie buckles in which there is mechanism for feeding the wire and for cutting it off and a means operates at a right angle to and across the path of the feeding mechanism to give one bend to the wire while another means operates in the direction of the feeding mechanism to give another bend to the wire and a final buckle forming means operates at an angle from the opposite side of the movements of the two bending mechanisms and the feeding, bending and forming mechanisms are operated in proper sequence.

New Patent Legislation in New Zealand.—A new act relating to patents, designs and trade-marks went into effect July 1st, 1912, in New Zealand. The new act differs from the old chiefly by the inclusion of a provision that any patent not worked in New Zealand within four years from the date it is granted, or within two years after the commencement of the new act, may be revoked by the Supreme Court on the petition of the Attorney-General or upon the petition of any other person with the leave of the Attorney-General. The American consul suggests that it is ordinarily the part of wisdom for American manufacturers whose goods are suitable for New Zealand and who intend to introduce them in such country, to secure New Zealand patents as otherwise imitations may be made by the New Zealanders, many of whom possess mechanical ability of a high order, and the spirit of invention is such that it often causes improvements on imported inventions.

Legal Notes

Patentability on Interference Appeal.—The Court of Appeals of the District of Columbia in the case of Hopkins v. Cleal, Cleal v. Hopkins, has held that on an appeal from the decision of the examiner awarding priority, the question of patentability of the issue will not be considered.

The Importance of Diligence.—The Court of Appeals of the District of Columbia rarely loses an opportunity to emphasize the importance of diligence on the part of an inventor. In the recent case of Courson v. O'Conner, O'Conner conceived the invention in November, 1908, and immediately set about reducing it to practice and filed his application on February 4th, 1909. Courson who had conceived the invention in 1898 made devices and tested them; but such tests were insufficient to establish a reduction to practice. The last of these tests was just prior to O'Conner's conception. Courson did nothing further with the invention until his application was signed on January 19th, 1909, which application was not filed till February 8th, 1909, and the Court held that Courson had every facility at hand to enable him speedily to reduce his invention to practice or file his application at a much earlier date, he was lacking in diligence, and that priority was properly awarded to O'Conner. The decision goes on to quote what Mr. Justice Robb said in a previous case to the effect that there is no arbitrary rule or standard by which diligence may be measured, the sole object of the law being to mete out the fullest measure of justice, and each case must be considered and decided in the light of the circumstances of that case. The nature of the invention, the situation of the inventor, the length of time intervening between conception and reduction to practice, the character and reasonableness of the inventor's testimony and that of his witnesses—are all important factors in determining the question of diligence.

Trade-mark Notes

A Trade-mark Opposition.—In the case of Consumers' Company v. Hydrox Chemical Company, Assistant Commissioner Tennant has decided that the opposition was properly dismissed since peroxide of hydrogen does not constitute goods of the same descriptive properties as distilled water nor merchandise of such character as to come within the natural expansion of the previous business of the opposer.

Difference Between Trade-mark and Patent Interferences.—In pointing out a distinction between a trade-mark interference and a patent interference, Mr. Justice Robb of the Court of Appeals of the District of Columbia has said: "In a trade-mark interference proceeding, the issue which the Commissioner is called upon to determine is not merely one of priority, as in a patent interference proceeding, but involves any issue that might be raised in an *ex parte* case. (*In re* Herbst, C. D., 1909, 333; 141, O. G., 286; 32, App., D. C., 565.)"

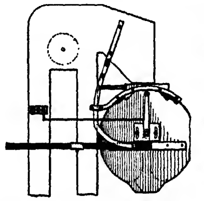
Trade-mark Applied to Publications.—In the case of Chilton Printing Company v. The Class Journal Company, Assistant Commissioner of Patents Billings has decided that the words *The Automobile Trade Directory* as applied to applicant's publication must be held to constitute a valid trade-mark, these words not being so wholly descriptive of the publication as to fall within the prohibition of the statute; also that the title *The Automobile Trade Directory* is not so similar to the title *The Cycle and Automobile Trade Directory* as to be likely to cause confusion in the mind of the public when applied to the same class of goods.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

AUTOMATIC GRAIN WEIGHER.—E. L. ADAMS, Edgar, Clay Co., Neb. This device is operated automatically by the weight of grain it receives. It comprises a hollow vessel with an inlet at one end and an outlet at the other, and comprising means by which grain can enter the vessel until its limit of capacity is reached. Means also provide for the automatic discharge of the grain, and it

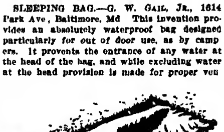


AUTOMATIC GRAIN WEIGHER.

passes continuously into the receiving vessel at one end and is delivered at the other, being retained long enough to actuate the mechanism which controls the outlet, and to register the times the outlet mechanism is actuated in this way, so as to indicate the measure of the total quantity of grain passing through the weigher. A side view of the device is shown in the illustration.

Of General Interest.

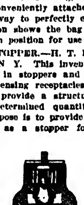
SLEEPING BAG.—G. W. GAIL, JR., 1614 Park Ave., Baltimore, Md. This invention provides an absolutely waterproof bag designed particularly for out of door use, as by campers. It prevents the entrance of any water at the head of the bag, and while excluding water at the head provision is made for proper ven-



SLEEPING BAG.

tilation. The occupant may enter the bag conveniently and blankets may be held in proper position with the bag, and a mosquito net may be conveniently attached at the head portion in a way to perfectly exclude insects. The illustration shows the bag staked to the ground, and in position for use.

BOTTLE STOPPER.—H. T. RAY, 6 Warren St., Hudson, N. Y. This invention relates to improvements in stoppers and measuring devices for dispensing receptacles, and has for an object to provide a structure which will dispense predetermined quantities of liquid. A further purpose is to provide a valve mechanism acting as a stopper for bottles and



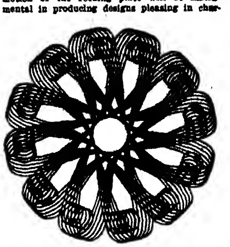
BOTTLE STOPPER.

the like, from which liquid is designed to be dispensed, which will permit the drawing of successive predetermined quantities of liquid from the receptacle, but will resist any refilling of the receptacle through the discharge point. The engraving shows a longitudinal vertical section through the invention as applied to a bottle.

LEAK STOP FOR LEVEES, DIKES, ETC.—M. M. NEAMSE, St. Patrick, La. This invention is an improvement in protecting covers for levees, dikes, etc., in the nature of a revetment, designed especially for preventing breaks or crevasses because of the leakage of water through craw-fish and musk-rat holes or because of other defects in the structure.

HAND BAG.—H. COHN and F. BESSANSON, 2nd St., Manhattan, N. Y., N. Y. This invention is an improvement in bags which are provided with pivoted U-shaped clips or clasps adapted to hold the jaws of the bags securely closed when the latter are suspended by the handle. The clasps are pivoted to one of the jaws and held from sliding laterally by a loose sleeve applied to the pivots.

DEVICE FOR MAKING DESIGNS.—L. L. ALLEN, L. B. 701, Atlanta, Ga. This invention relates to devices for making designs, and the object is to provide one having a bar carrying a marking member which contacts with a member secured to a pivoted table so that when the table is rotated, and one end of the bar is articulated to a rocking plate, and the other end engages a guide, the reverse motion of the rocking plate will be instrumental in producing designs pleasing in char-



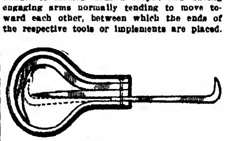
EXAMPLE OF DESIGN DEVICE WORK.

acter. Means provide for articulating the bar to any one of a plurality of points on the rocking plate to adjust the position of the guide relating to the pivot point of the table, and to articulate an end of the bar to a member having continuous rotary movement instead of to the rocking plate. The engraving pictures an example of the design work of this invention.

MAIL BAG AND BAG SUPPORT.—H. T. COOK, 332 So. Michigan Ave., Chicago, Ill. This invention has particular reference to a bag with means for supporting the bag in open position, particularly within a letter box, so that the letters drop directly into the bag, it being only necessary for the collector to substitute an empty bag for the bag removed. This also avoids unnecessary and frequently injurious handling of a mass of letters incident to removing them from the box in the ordinary way.

Hardware and Tools.

COMBINATION TOOL.—REV. C. BAUER, Clara City, Minn. In the accompanying engraving one of the implements of the tool is shown in operative position, and in a folded or inoperative position in dotted lines. The handle is formed with a looped end having engaging arms normally tending to move toward each other, between which the ends of the respective tools or implements are placed.



COMBINATION TOOL.

A pivotal pin is passed through all of the implements so that the same swing on the same pivotal center and may be moved in and out as desired, the respective implements being provided with projections co-acting with suitable sockets for locking the implements in either a folded or an unfolded position.

FOOT POWER VISE.—G. E. CALLAWAY, care of J. M. Bradley, Sec'y, Jonesboro, La. This invention has for its purpose the provision of an automatically operating device wherein the jaws are counterbalanced to open of themselves, and the operating mechanism is counterbalanced to return to original position when released.

PIPE REAMER.—D. M. HATTON, Burnett's Creek, Burnettsville Station, Indiana. An object here is to provide a device of a relatively simple nature for reaming pipes in which the power required is reduced to a minimum. The invention provides interchangeable pipe holding parts to accommodate pipes of various size, these parts being capable of quick application to the main supporting frame or removal from it.

ANIMAL TRAP.—J. F. WINKLER, P. O. Box 86, Dollar Bay, Mich. This invention provides a construction whereby the setting of a trap may be rendered automatic in so far as the engagement of the striker and its latch. A base and a bait carrier are constructed with

Classified Advertisements

a view to enable the operator to move the bait carrier into engagement with the latch member, when setting the trap, without danger of his fingers being caught by the striker.

INVISIBLE HINGE.—E. ZUCKERMAN, 395 Kimball Ave., Yonkers, N. Y. This invention provides an invisible hinge for use on doors boxes, pianos, furniture and other articles and devices, and arranged to be invisible when the door or other movable member is in a closed position, and provides a space between the movable and the fixed member when the door is opened.

Household Utilities.

COOKING APPARATUS.—W. E. BAXTER, care of Varbe-Frazier Co., Ltd., Louisville, Ky. The construction in this case is in the nature of a combined cooking and heating stove and combined house and camp (or portable) stove. The invention provides a non breakable crate and support adapted to inclose the stove proper for shipment, carrying by hand or storage for the stove proper when the crate is placed below the stove proper.

WASHTUB.—J. J. REILLY, 161 S. 8th St., Newark, N. J. The more particular purpose here is to provide a tub having a special form whereby it is adapted to be used in connection with a wringer so located within it that the combination of tub and wringer presents a number of advantages in the conjoint use of these parts.

LEG REST FOR ROCKING CHAIRS.—L. AIME, 25 Haig St., and J. STENGER, Jersey City, N. J. For the purpose of this improvement use is made of a leg rest provided with rockers and connected with the rocking chair to support the leg rest in upright position, and to allow of rocking the leg rest in unison with the rocking chair.

Machines and Mechanical Devices.

DOOR MECHANISM FOR ORE POCKETS OR SIMILAR RECEPTACLES.—R. B. PEARSON, 401 London Road, Duluth, Mich. The principal purpose here is to so construct the door and attached mechanisms as to provide an efficient door action which will be semi-automatic in opening and comparatively easy of closure against a head of ore or other material in the pocket when it is desired to stop the flow of the same.

LOOM FOR WEAVING GAUZE.—E. K. GEISE, care of Scholer, Duplan Silk Co., Hazleton, Pa. The object here is to produce a loom in which the needle reed is positively moved in fixed guides, and in which the flexing reed is located between the needle and the warp beam, and is positively reciprocated in a fixed guide in parallel relation to the needle reed, and a further object is to do away with the necessity of using any harness to manipulate and guide the threads.

Pertaining to Vehicles.

RADIATOR SHIELD.—F. F. BASSETT, Lawrence, L. I., N. Y. This invention pertains to a shield of a type used in automobiles, and is adapted to cover a portion of the radiator and protect it from the cold, so as to prevent an excessive cooling of the water in the radiator, and also to prevent the freezing of the water when the radiator is not in use.

Designs.

DESIGN FOR A TOILET POWDER DISPENSER.—E. OLDENBUSCH, care of Kronheimer & Oldenbusch, 366 Butler St., Brooklyn, N. Y. In this ornamental design for a toilet powder dispenser the body is of a narrow shaft-like form with a small round shaped mirror placed at the top end of the article.

DESIGN FOR A COMBINED KNIFE AND FORK.—M. S. HEWITT, Georgetown, Tex. In this ornamental design the article comprises a slightly curved handle to a knife blade of modified sickle form at the point of which and at right angle to the blade extends a short broad four-pronged fork.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The "Immortality" of Tissues

(Concluded from page 344.)

diminution after a certain age until the growth altogether ceases, and the size of the animal is determined. But it was found by subjecting these artificial growths to washings in salt solution that the mass was *fifteen times greater at the end than at the commencement of the third month, showing that they do not grow old at all!* In the artificial growth the problem of senility and death is solved! It was the announcement of this "permanent life of tissues" that caused such a furor in Paris last summer, and several eminent scientists to demand ocular demonstration, because "the discovery, if true, constituted the greatest scientific advance of a generation."

The following summary of this interesting and vitally important and epoch-making work of Carrel is translated from an article published in Paris recently by Prof. Pozzi,* who witnessed the experiments:

"Carrel found that the pulsations of a fragment of heart, which had diminished in number and intensity *or ceased*, could be revived to the normal state by a washing and a passage. In a secondary culture, two fragments of heart, separated by a free space, beat strongly and regularly. The larger fragment contracted 92 times a minute and the smaller 120 times. For three days, the number and intensity of the pulsations varied slightly. On the fourth day, the pulsations diminished considerably in intensity. The large fragment beat 40 times a minute and the little fragment 90 times. The culture was washed and placed in a new medium. An hour and a half after, the pulsations had become very strong. The large fragment contracted 120 times a minute and the small fragment 160 times. At the same time the fragments grew rapidly. At the end of eight hours they were united and formed a mass of which all the parts beat synchronically.

"Carrel then tried to preserve three fragments of heart in a state of functional activity for several months. One of the three experiments will be described.

"On the 17th of January, 1912, a fragment of the heart of an embryo chicken of seven days was placed in plasma. It grew rapidly in a thick crown of conjunctive cells. At the end of some days, the pulsations, which were regular and strong at the beginning, grew feeble and ceased completely. For more than a month, the fragment remained immobile. On the 29th of February, the culture which had been subjected to fourteen passages was dissected, and the central fragment was placed in a new medium. After the fifteenth passage, it was observed to contract rhythmically, and that the pulsations were as strong and as frequent as on January 17th. The number of the pulsations was from 120 to 180 per minute. During the months of March and April, the small fragment of heart continued to beat vigorously at from 60 to 120 times per minute. As the growth of the conjunctive tissue became more active, it was necessary before each passage to extirpate the new connective tissue that had formed around the muscle. On the 17th of April the fragment beat 92 times a minute. The contractions were regular and agitated all the mass of tissue and the neighboring part of the middle of the culture. On May 1st, the pulsations became more feeble. They were then subjected to their thirty-fifth passage. In the course of the manipulation, the muscular tissue was stretched and torn. The rhythmic contractions definitely ceased."

Experiments to date seem to establish that the connective tissue, at any rate, is "immortal."

From this research, it is possible to arrive at certain logical conclusions, which, however, it remains for the future to confirm. One, and the most important, is that the normal circulation of the blood does not succeed in freeing all the waste products of the tissues, and that this is the cause of senility and death.

* "Vie Manifestée Permanente des Tissus," *La Presse Médicale*, p. 532.

Were science to find some way to wash the tissues in the living organism as they have been washed in these cultures, man's life might be indefinitely prolonged.

A Scenic Painter's Studio

(Concluded from page 349.)

special mordant on which gold foils are brushed.

Movable scenes are dealt with in the same manner as the large background scenery. The canvas used in this connection is stretched out on special woodwork frames made by the joiner (Fig. 6). In order to facilitate the shifting of these frames special importance should be attached to making the frames as light and substantial as possible; they are supplied to the scenic painter on his own plans (sometimes in conjunction with the theater foreman).

The making of scenery rendering artistically cut foliage, tendrils, and similar fine details is an especially difficult task. The following process has been of late adopted in this connection: After painting the scenery and cutting out its outline, it is turned around and lined with a fabric consisting of light meshes of black yarn. This fabric is cut to the proper dimensions and coated on the back with heated glue. Before the latter has dried, small strips of tissue paper of different breadths (in accordance with the shape of the leaves) are applied, thus obtaining a substantial whole.

In order to allow the effects of scenery to be tested after completion, an observation bridge commanding a good view of the canvas is generally installed at a height of 15 to 20 feet on one of the walls of the studio (Fig. 7). Movable scenery need only be set up vertically, in order to give the same impression as on the stage (apart from lighting effects), which facilitates the painter's task.

The last thing to do is to apply the finishing touches on the stage, with the electric lights turned on mainly to secure accordance with the actors' dresses, putting on a new tone here and there and attenuating or reinforcing the tints wherever necessary to produce the desired effects (Fig. 8). A finished example of the painter's work is shown in Fig. 9 in an exterior view from the third act of "Faust."

The Proposed Trans-Sahara Railway

A RAILROAD project of great scope is the Trans-Sahara line, which the French government proposes to carry out in the near future. Not long ago several expeditions were sent out in order to study the conditions for running the railroad across the desert region, and this part of the work is now terminated. It is thought that the entire plans can be drawn up before the end of this year. Such a railroad will afford a connection between Algeria, Morocco and the desert region, with the French colonies situated in the regions of the Congo and the Niger, so as to inter-connect all the colonies, whence a great advantage will be secured not only for commerce, but also for military purposes, allowing the native troops which it is proposed to raise in the Senegal and Congo region to be transported to the north of Africa or even across the Mediterranean into France under the protection of the fleet. The present expedition consisted of a number of leading engineers and officers of the War Department, and a caravan of 50 men and 120 camels started from El Aoulef, the southern terminus of the Algerian railroad, in order to cross the desert. The expedition divided at Silet in order to explore several different regions. Among others, Dr. Nieger took a southeastern route, so as to find the best conditions for running the railroad as far as Lake Tchad. His party then returned through British Nigeria by way of the new railroad from Kano to the coast. The other expeditions followed different routes in order to trace lines for the general project, and in all cases the proposed lines make connection with already-existing railroads in the southern region lying between Timbuctoo and Lake Tchad.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

"Roundhouse Attention" for Motor Vehicles

By John R. Eustis

THAT more commercial motor vehicles fail to give satisfactory service because they are not operated and cared for properly than because of inferior design and construction is a fact well known to transportation engineers. The modern motor truck and delivery wagon are built to stand hard service, provided they are properly cared for in the garage.

"Roundhouse attention" is the name given to this requirement, and it is taken from railroad parlance. Its significance in this case is that the motor vehicle should have the same careful attention at the end of each day's work that the railroad locomotive receives at the end of each trip. If the locomotive requires inspection and adjustment at the end of a run over smooth steel rails, how much more should a motor truck receive the same after a long day's work over rough roads, in which it is jolted and strained in a way a locomotive is never subjected to. The time required for this is seldom longer than it takes a horse driver to unharness, clean and feed his team at the close of a day's work.

Such attention pays for itself many times over in dollars and cents. There is almost as much opportunity to increase motor truck efficiency in the garage service as there is in providing proper loading and unloading facilities or in routing deliveries. The railroads furnish an illustration of this, in that the total cost per locomotive mile for the four leading lines running out of New York, for the year 1911, varied from 4 to 16.6 cents, and the lowest figure was for the line with the severest grades. This variance of over three hundred per cent must be largely attributed to the difference in maintenance service.

The Horse's Board Bill

ONE factor which is exerting a powerful influence in favor of motor trucks is the steadily increasing cost of using horses, purchase price and maintenance, stable rent, drivers' wages and feed included.

According to Census Bureau figures the valuation of horses in the United States has increased 137 per cent in the last ten years, while the increase in number has been only 13 per cent. The total number at the time of the last census was 24,016,024.

In the same period the value of hay has advanced from $10 per ton to over $20, and corn and oats have increased in value proportionately. Land values have increased in most sections of New York, taxes in all sections, and these are the factors which govern the renting value of stable properties. This same condition holds true in practically every commercial center.

Motor Trucks at the Electrical Show

AT the recent Electrical Exhibition in the New Grand Central Palace, New York, motor trucks were well represented. There were half a dozen different exhibits in which the motor trucks were shown in varying types, from the powerful ones used by breweries to a small baggage truck of two thousand pounds capacity. Mounted upon one of the larger trucks was an automatic bottle capping machine. The machine was driven by power obtained from the battery of the truck. The manufacturers of this truck were anxious to display the model at the Electrical Show, but the only one available was in service of the inventor of the bottle capping machine, who used this method of demonstrating his invention, and so they induced him to let them exhibit the truck, machine and all. The bottle capping machine, which, by the way, was a very ingenious one, served to attract attention to the truck exhibit and also emphasized the fact that the electric truck is very adaptable; for the power stored in its battery may be used to advantage on all manner of machinery mounted on it or in its immediate vicinity.

One of the most interesting features of the show was the indoor track on the third floor, where electric automobile demonstrations were made and driving lessons were given without charge, under the auspices of the New York Electric Vehicle Association. Not only were pleasure vehicles demonstrated, but also small electric trucks. To emphasize the fact that very little power is used by a truck, the following sign was displayed:

"Less current is consumed by a one-ton electric truck, carrying a load one mile, than by the above lamps, burning one hour."

The lamps referred to were three 32 candle-power carbon filament lamps. By a one-ton truck, of course, is meant a truck that carries a load of two thousand pounds. The weight of the truck itself would be in the neighborhood of four thousand pounds. Thus, we have about three tons, altogether, carried by 300 watts or 0.4 horse-power.

Delivery Service of New York's Department Stores

By Morris A. Hall

THERE are said to be 1,405 department stores in the United States, of which New York city possesses not less than 10 per cent, and probably more, Manhattan alone being credited with 90, while a good many of the largest are classified as drygoods stores. These serve not less than 15,000,000 people.

To do this, it has been necessary in the past to maintain enormous stables of horses, with a tremendous proportion of reserve horses in order to take care of all emergencies. With the coming of the motor truck, however, this has been changed materially, and although the total number of horses and wagons is still very large, the greater proportion of these is the property of smaller and less progressive firms. In fact, it may be stated that now four of the largest firms are using no horses whatever, and not less than six will be in a similar condition within two years.

The whole number of motor vehicles now used by the New York department stores is estimated by the writer at 700, with 525 in Manhattan, and 175 in Brooklyn and other boroughs. Of these approximately 290 are electrics, the balance, 410, gasoline. At the same time, about 3,000 horses are still in use hauling 1,900 wagons. Some of these will never be replaced, but approximately half of them will, making a place with the natural growth of the businesses for about 1,000 more trucks in the next five years.

Some idea of the extent of area served and magnitude of the general proposition of large department store delivery may be gained from a description of several of them. R. H. Macy & Co., for instance, covers all places south as far as Lakewood and Point Pleasant, New Jersey, as far west as a straight line north and south through Boonton, Parsippany, Summit, and Fanwood, New Jersey, as far east as Woodbury and Oyster Bay, Long Island, and Stamford, Conn., and as far north as White Plains, Elmsford and Pearl River, New York, and Ramsey, New Jersey.

This makes an area 30 miles wide by 65 miles long, out of which the [illegible]

is a corner approximately 25 by 80 miles. These figures give a resulting land area covered of 2,500 square miles in round figures; that is, half as big as the entire State of Connecticut.

To cover this area in anything like a proper manner requires organization and a well thought out plan. There are nearly twenty depots or sub-stations, the number varying with the character of the service. These are supplied by big 3 and 5-ton gasoline trucks, which make the long runs at night, and in some cases during the day. From the sub-stations radiate the actual deliveries by electric automobile when the distance is long, and by horse when it is short. The majority of retail deliveries in New York city are made from the main store, the Long Island City and Coney Island depots by means of light electrics. These have a radius up to 35 and 40 miles a day, whereas the best the horse can do is 16 to 18, with 22 as a maximum of isolated country delivery.

The entire system includes (the figures vary widely from one month to another): Forty-two motor vehicles, consisting of 7 gasoline trucks and 35 electrics, 200 horses and 150 wagons. For comparison another large store—John Wanamaker—has 75 motor vehicles, consisting of 70 gasoline and 5 electrics, 275 horses and 150 wagons. In the comparison, several points will be noted, primarily the much greater proportion of gasoline cars in the Wanamaker equipment. This shows the individual preference, the Macy Company having always found the electric vehicle very reliable and serviceable, whereas the Wanamaker firm could not be persuaded even to try them until a year ago. Another point is the much larger proportion of horses to wagons in the Wanamaker instance, this firm having 75 more horses for the same number of wagons. It is explained by the fact that horses go out but half a day, those working in the morning being replaced by fresh horses in the afternoon. This scheme enables the serving of a larger territory per wagon, but requires more horses.

Some of the other notable delivery systems of New York city are those of: Gimbel Brothers, which is entirely motor, no horses whatever being used; J. L. Kesner & Co., of which the same is true; Lord & Taylor, Stern Brothers, Greenhut-Siegel Cooper Company, Simpson-Crawford Company, and W. & J. Sloane, not strictly a department store, but having an interesting motor equipment which has gradually displaced all horses. Gimbel's now has 127 motors, 89 electric and 38 gasoline; Kesner's has 45 gasoline vehicles, 42 of the 1-ton size and all of one make; Stern's employs 28 gasoline cars and 2 electrics, as well as many horses; Sloane's has a fleet of 19 cars, of which 4 are electrics; the Greenhut outfit includes 17, all electrics, and many horses; Simpson-Crawford, 16 trucks of which half are electric, and 400 horses for 200 wagons; Lord & Taylor, 13 gasoline cars, 124 horses and 60 wagons; Aitken, Son & Co., 18 electrics and no horses; Arnold, Constable & Co., a fleet of 10 electrics, some gasoline cars and a few horses, and so on down to the smaller houses which have practically all horses, but are trying out a motor truck or two.

Cost figures are more or less difficult to handle, but it may be stated that the Macy electrics (34) averaged 10.15 cents a mile, while the gasoline cars did over 14,000 miles a year at a cost of 17.48 cents a mile. In the Sloane service, a 3-ton truck, doing 42 miles a day for 296 days a year averaged 26.1 cents a mile and 17 cents a ton-mile. Stearns found that the electrics cost about 13 cents a ton-mile, an automobile unit costing $1,780 a year, while the same service from horses came to $3,692 a year, a saving of $1,912 a year for each motor-driven unit. Simpson-Crawford's cost figures show a package cost of 6 cents each by horse and 2½ by automobile. Gimbel's delivery equipment covered 1,500,000 miles last year with an operating cost of 6 cents a ton-mile and a total cost of 60 cents a mile, Greenhut's 1,000-pound cars do 10,500 miles a year at a cost of 5¼ cents a mile, or 22 cents a ton-mile; the 1-ton cars, 10,100 miles at 22.46 cents a mile and the same a ton-mile; the 3½-ton electrics, 8,300 miles at a ton-mile total of 10.65 cents.

Generally speaking, the 1-ton truck will do 80 miles a day at a total ton-mile cost of 20 cents, or $8 a day, while a 1-horse wagon will cost $4 a day and do but 22 miles (maximum), making the ton-mile cost 86 cents. Moreover, these figures show that in mileage covered, the former is equal to 3.63, or since a horse cannot be divided, 4 1-horse outfits, which at the $4 a day figure, would amount to $16 a day. Hence, the motor shows a saving of about $12 a day on equal mileage requirements.

However, cost alone is not the deciding factor in the department store's gradual, but very certain adoption of motor trucks, that is its quickness of action, allowing of rapid delivery or as it is usually termed, more prompt service, an extension of available territory and a lowered cost being the secondary deciding factors.

Motor Truck Queries and Answers

F. P. S. writes: On a recent trip abroad I was much impressed by the number of motor omnibusses in service in the large cities, particularly in London and Paris. How many are there in this country, and why are they not generally used here as abroad?

A. The largest and oldest motor omnibus installation in this country is that of the Fifth Avenue Stage Company in New York, which is now operating close to one hundred vehicles. There is a line of four or five running on one of the principal residential thoroughfares of New Haven, Conn., which is nearly as old. A company began operations in Chicago last fall and now owns about a score of vehicles, while another has begun in a small way in Indianapolis. There are a large number of motor stages of various kinds in use throughout this country, and these might be classed as omnibusses. The total number is small, however, compared with the 1,500 motor omnibusses in London and the something more than half this number in Paris.

Among the reasons which undoubtedly explain why motor omnibusses are not generally used here as is the case abroad, is the fact that all types of commercial motor vehicle are of more recent origin in this country than in Europe. Other forms of passenger transportation, particularly the electric street car, have been more highly developed in American cities so that there is not the same need for motor omnibusses. The inferior street surfaces and the difficulty of securing franchises are other contributing factors. Passenger transportation in competition with street cars and interurban trolleys is one of the most promising fields which the future holds for the commercial motor vehicle in this country.

A. J. B. asks: Is motor truck travel unusually hard on stone roads, in comparison with pleasure car and horse traffic? What is the best kind of road surface for motor truck travel?

A. Your questions represent problems as yet unsolved. When motor trucks are over-loaded and over-speeded and unfortunately this is the rule rather than the exception, they are harder on roads than pleasure cars. When road surfaces begin to loosen and show holes, and this condition is largely caused by horse traffic, then motor truck travel becomes destructive, as a heavily loaded, fast moving truck hits each depression with a trip hammer blow. As practically all roads are used by the three kinds of traffic you mention it is difficult if not impossible to ascertain which is the most destructive. Although there are many opinions on the subject, it would seem that a concrete base with a macadam top, the surface of which is bound with a heavy oil of tar, would be the best for motor truck travel.

Lesson of the Railroad Wreck at Westport

(Concluded from page 344.)

like action it lurched over to the right, and was in this position when it entered the second half of the crossover. Here the reaction of the curve on the flanges of the wheels caused the engine to continue heeling over to the right until equilibrium was entirely lost. The wheel flanges (see small sketch) lifted clear of the inner edge of the rail, and the engine shot straight ahead for seventy to eighty feet, landing on its outer right-hand wheels upon the ties on the outside turnout to outer track of the siding. When the writer inspected the scene of the wreck, he found there was not a single scratch on ties or rails throughout the whole crossover.

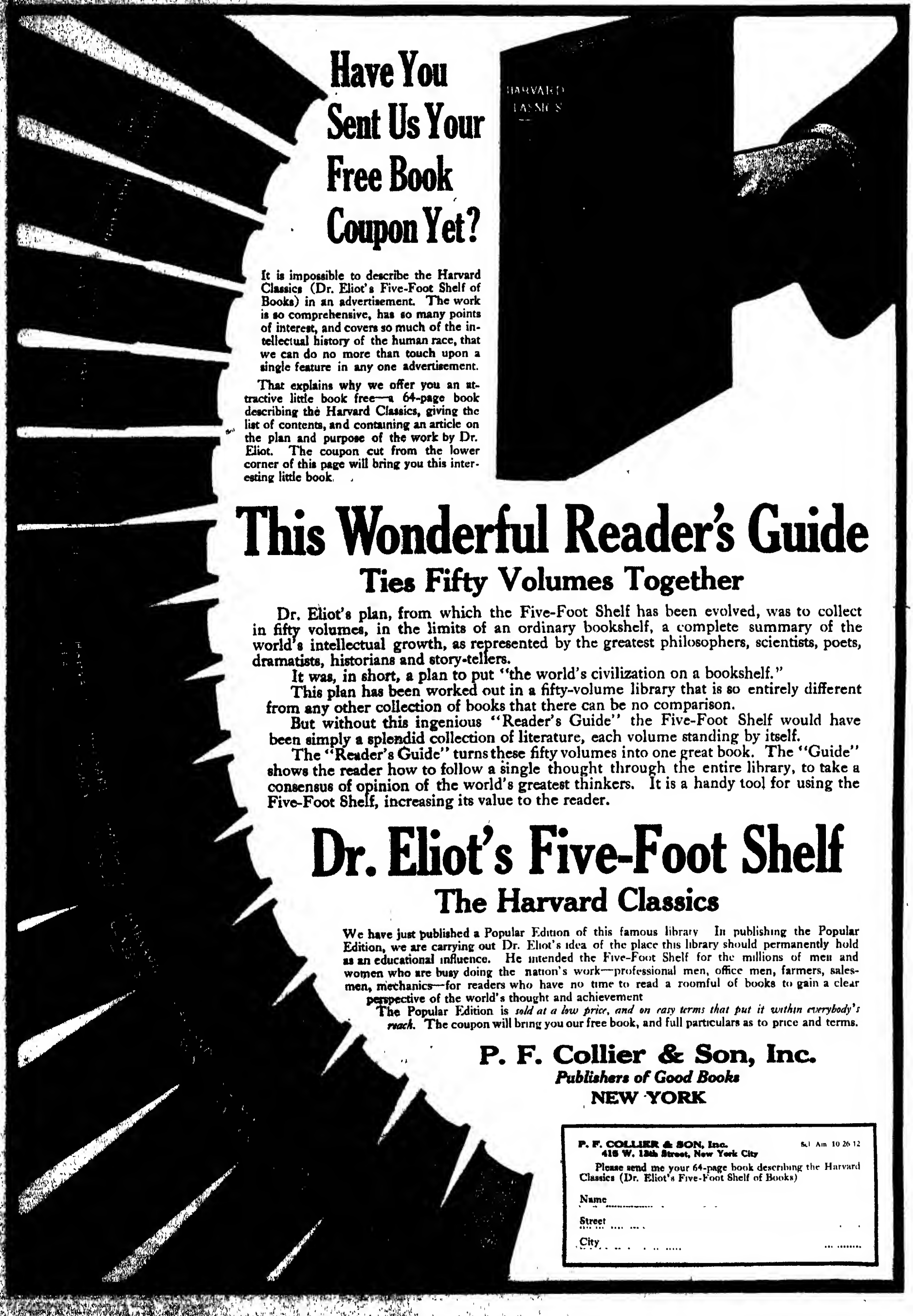
Now the centrifugal force developed against a curved rail is inversely proportionate to the radius of that curve. The longer the radius, the smaller the centrifugal force. It is perfectly possible (though, of course, more expensive and requiring more careful workmanship) to make a crossover so long and its curvature so easy, that the centrifugal effect, even at sixty miles an hour or more, will not imperil the safety of the train. These facts are well known to railroad engineers, and of late years our best railroads, those which are sincerely desirous to do everything possible to render railroad travel safe, have been taking up the short crossovers laid down in an earlier day and substituting others of a safer type. The New York Central uses, under conditions similar to those at Westport, a No. 18, the radius of whose switch rail is 2,521 feet. The Pennsylvania Railroad Company uses a No. 20, with a radius of 3,442 feet. The Westport No. 10 has a radius of only 942 feet. Consequently, had a New York Central crossover been in place at Westport the centrifugal force would have been not much more than one third as great, and with a Pennsylvania No. 20 in place, it would have been not much over one fourth of that developed by the wrecked train. The New York Central Company has a speed limit, we believe, of forty miles per hour for its No. 18, and the Pennsylvania Railroad imposes no speed limit on its No. 20, the curvature being so easy as to be safe at any speed at which the train can be run.

Furthermore, in showing how well this matter is handled by roads whose officials are sincerely desirous of doing everything, both in the physical construction of the road and in the maintenance of strict discipline, to safeguard its passengers, it should be mentioned that on the shorter crossovers on the Pennsylvania lines on which speed limits are imposed, tests are made at regular intervals of the speed at which engineers run over them. The engineers do not know when such tests will be made, and a violation of the rule meets with instant punishment.

The SCIENTIFIC AMERICAN commends these facts to the serious attention of the general public, and expresses the hope that in the forthcoming legislation which will undoubtedly be the outcome of the Interstate Commerce Commission's investigation of this matter, the constituencies will make it clear to their representatives in Congress that they wish the recommendations of the Commission to be embodied in early and drastic legislation.

Russian Military Flying Machines

THE aeroplanes which will take part in the War Department competition course in Russia are almost entirely of home construction. The entries were closed on August 22d, and it is thought that at least fifteen aeroplanes made by Russian constructors will take part. A series of [illegible] outside the official event will also form part of the programme, and the Russian pilot, [illegible], who recently made a flight on his Gnome-Wright biplane from Berlin to St. Petersburg, is to take part. It is said that a Holland [illegible] will make flights with an [illegible] of a new system.


Have You Sent Us Your Free Book Coupon Yet?
HARVARD CLASSICS
It is impossible to describe the Harvard Classics (Dr. Eliot's Five-Foot Shelf of Books) in an advertisement. The work is so comprehensive, has so many points of interest, and covers so much of the intellectual history of the human race, that we can do no more than touch upon a single feature in any one advertisement.
That explains why we offer you an attractive little book free—a 64-page book describing the Harvard Classics, giving the list of contents, and containing an article on the plan and purpose of the work by Dr. Eliot. The coupon cut from the lower corner of this page will bring you this interesting little book.
This Wonderful Reader's Guide
Ties Fifty Volumes Together
Dr. Eliot's plan, from which the Five-Foot Shelf has been evolved, was to collect in fifty volumes, in the limits of an ordinary bookshelf, a complete summary of the world's intellectual growth, as represented by the greatest philosophers, scientists, poets, dramatists, historians and story-tellers.
It was, in short, a plan to put "the world's civilization on a bookshelf."
This plan has been worked out in a fifty-volume library that is so entirely different from any other collection of books that there can be no comparison.
But without this ingenious "Reader's Guide" the Five-Foot Shelf would have been simply a splendid collection of literature, each volume standing by itself.
The "Reader's Guide" turns these fifty volumes into one great book. The "Guide" shows the reader how to follow a single thought through the entire library, to take a consensus of opinion of the world's greatest thinkers. It is a handy tool for using the Five-Foot Shelf, increasing its value to the reader.
Dr. Eliot's Five-Foot Shelf
The Harvard Classics
We have just published a Popular Edition of this famous library. In publishing the Popular Edition, we are carrying out Dr. Eliot's idea of the place this library should permanently hold as an educational influence. He intended the Five-Foot Shelf for the millions of men and women who are busy doing the nation's work—professional men, office men, farmers, salesmen, mechanics—for readers who have no time to read a roomful of books to gain a clear perspective of the world's thought and achievement.
The Popular Edition is sold at a low price, and on easy terms that put it within everybody's reach. The coupon will bring you our free book, and full particulars as to price and terms.
P. F. Collier & Son, Inc.
Publishers of Good Books
NEW YORK
P. F. COLLIER & SON, Inc. 415 W. 13th Street, New York City
Sci Am 10 26 12
Please send me your 64-page book describing the Harvard Classics (Dr. Eliot's Five-Foot Shelf of Books)
Name
Street
City

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 18.] NEW YORK, NOVEMBER 2, 1912. [10 CENTS A COPY $3.00 A YEAR

Photos. copyrighted by J. A. Wilson.

These photographs were taken at Fort Monroe. The first shows the 12-inch projectile, just beyond the gases, about 50 feet from the gun. The camera was actuated electrically by means of the projectile.

THE DISCHARGE OF 12-INCH GUNS.—[See page 365.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 2, 1912

Published by Munn & Co, Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions
Mexico, Cuba, and Panama
Subscriptions for Foreign Countries one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid. 3.75

The Scientific American Publications

Scientific American (established 1845) .... per year, $3.00
Scientific American Supplement (established 1876) . " 5.00
American Homes and Gardens .... " 3.00
The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Our Panama Canal Number

FROM the time, some ten or twelve years ago, when the construction of a Trans-Isthmian Canal by the United States began to be seriously considered, the SCIENTIFIC AMERICAN has devoted much attention to this great national enterprise. Mainly on technical grounds, we were an earnest advocate of the construction of this canal at Panama, having foreseen the great engineering difficulties and the subsequent risks of operation which would attend the construction of a canal at Nicaragua. The progress of the work at Panama has been a prominent feature in this journal from the time when the canal was taken over by the United States from the French Construction Company, and this monumental work has formed the subject of frequent illustration, description and comment.

It gives us much pleasure to present in the next issue of the SCIENTIFIC AMERICAN a fully illustrated description of the Panama Canal, written by members of the Isthmian Canal Commission and by the various technical officials who have been in charge of the work. Because of the fact that the articles are written by the men who have been in charge of the work, this number will have particular value, authority, and interest to our readers. Many facts, hitherto unrecorded, relating to the difficulties of construction and the way in which they have been overcome, will be given by the engineers who were on the ground and had to meet the various contingencies as they arose and find a practical solution thereof.

The Panama Canal Number will open with an article by Lieutenant-Colonel Siebert, of the Corps of Engineers U. S. Army, who has had charge of the construction of the great triple-flight locks and the huge dam at Gatun, which constitute in themselves a work of a magnitude unsurpassed in the history of hydraulic engineering. We have all heard much about the great Culebra cut through the mountain divide and of the enormous slides which have developed during the progress of excavation. This subject is handled in a clear and comprehensive way by the army engineer who has been in charge of the Culebra Cut for the last five and one half years, Lieutenant-Colonel D. D. Gaillard. So excellent have been the organization and the efficiency of the plant and methods of excavation and transportation, that, although some twenty-two million cubic yards of slides have come down into the Culebra cut during construction, the total cost of the work will not exceed the preliminary estimate of cost—a record of which Col. Gaillard may very justly be proud.

It is very well understood by everyone who has even thought about the Panama Canal, that its construction would have been impossible but for the fact that the two great scourges of the Isthmus of Panama—yellow fever and malaria—have been either completely exterminated or thoroughly controlled by the Sanitary Department under Col. Gorgas. This subject is treated in a very readable way by Dr Orenstein, one of the members of the staff under Col. Gorgas.

With the near approach of the opening of the Canal, the question arises as to its future commercial value to the United States. We have been fortunate in securing an article on this subject from a member of the Isthmian Canal Commission, Prof. Emory Johnson, the expert statistician of the canal. Prof. Johnson shows in his article what are the principal trade routes of the world, how they will be affected by the opening of the canal, and what are the reasonable prospects of attracting to the canal a large and paying proportion of this trade

When the canal is opened, electricity which during the past two decades has entered so largely into all great constructive work and the operation thereof, will become the all-but-universal motive power in the operation of the great waterway This subject will be treated in a comprehensive manner by one of the leading engineers in the field of electrical engineering

A Coming Profession

SO far as our knowledge goes the city of Sumter S C is justified in claiming that it has introduced "a new and coming profession Through the secretary of its Chamber of Commerce, that enterprising community of ten thousand people has announced that applications will be received for the office of city manager of Sumter From the brief summary of the requirements for this office, we gather that the applicant should be competent to oversee public work, such as paving lighting water supply etc. that an engineer would be preferred that he must state what has been his previous experience in municipal work that he will have complete administrative control of the city subject to the approval of a board of three elected commissioners, and that he will hold office so long as he gives satisfaction to the commissioners that his work will be purely that of an expert and that he will be entirely free from political control finally although local conditions and tradition will be taken into consideration local citizenship will not be necessary

The announcement concludes by designating this as "A splendid chance for the right man to make a record in a new and coming profession since this is the first time that a permanent charter position of this sort has been created in the United States If the last statement is correct, the SCIENTIFIC AMERICAN congratulates the little city on having inaugurated a movement whose beneficial results in the orderly economical and righteous administration of municipal affairs will make themselves increasingly apparent.

Supply and Demand in Motor Fuels

THE question of an adequate supply of gasoline for internal combustion engines is again becoming acute Several times during the past eight months the price of this automobile necessity has been raised, until it now is 60 per cent higher than last winter The Standard Oil Company as well as the independent refineries of course hold the increasing demand and practically stationary supply responsible and as the truth of their claims cannot be denied, it behooves the manufacturers interested in motors and motor vehicles to adapt their engines to the use of other hydrocarbons than gasoline.

The suggestion is not new it has been discussed time and again Benzol alcohol and kerosene have been tried and found wanting—in the carbureters used for gasoline engines. The fault was not with the fuels, but with the carbureting devices employed Excepting for the apparent reluctance of manufacturers of motor cars to provide the small extra equipment necessary to attain this desirable end there is no reason whatsoever why kerosene or benzol should not make highly satisfactory fuels for the automobile motor Nearly every gasoline tank has an emergency tank built in Why could not this tank be used as a starting tank and the main compartment be filled with kerosene? The carbureter adjustment for kerosene is slight a mechanical air valve could be attached so as to supply the mixture with more oxygen than is necessary for running with gasoline The carbureter could be water jacketed or otherwise warmed, so as to facilitate gasifying of the fuel, as is done in many cases even now

As one of the officials of the Standard Oil Company recently explained to the writer the whole trouble with the gasoline supply of this country is not at all in the supply of crude oil but in the inability of the refiners to get rid of the kerosene and other heavier fuels obtained in the process of distillation When kerosene was used in households to a much greater extent than at present, the gasoline—then an almost useless by product—was sold at ridiculously low prices. Now the positions are reversed gasoline sells for a high price because it finds a ready market at any time while kerosene is the by product. The moment that manufacturers of carbureters and motor cars learn to use both fuels interchangeably—gasoline for the first few miles, and then, when the motor is warmed, kerosene—the price of the former will fall and that of kerosene rise The increase in price of the latter fuel however, need not worry the motorist, for kerosene is more economical and satisfactory in many ways than gasoline And should the "oil trust" and the independents feel inclined to still further raise the prices of both gasoline and kerosene, there is enough coal tar made in this country to supply fully [illegible] demand with the coal tar [illegible]. The matter lies entirely with the [illegible] carbureting devices and cars.

Achievements in Aviation

THE winning of the International Cup Race at Chicago two months ago by Vedrines at an average speed of 105 miles an hour, and the making of a single circuit of the 4.14 mile course at 108.05 miles, was but one of the astounding performances accomplished of late by Frenchmen in the field of aviation.

Besides the remarkable long distance flights from Paris to Berlin and from Antwerp to Paris that have been made by Frenchmen, they have set up other remarkable distance, duration and altitude records. The most noteworthy distance and duration record was made by Alexander Fourny, chief instructor of the Maurice Farman School at Buc. Fourny was the holder of the duration record—11 hours 2 minutes and 29 seconds—for the past year but not of the distance record for a non-stop flight above an aerodrome, as this—461 miles—was made by Gobé on a fast Nieuport monoplane last year. On September 11th Fourny set out to break both records, and he succeeded despite violent squalls and showers which hindered him throughout the day Starting at 5 58 A. M. with 71 gallons of gasoline in his tanks, Fourny circled the aerodrome at Etampes continuously for 13 hours and 22 minutes, covering a distance of 1 017 kilometers (631.93 miles) at an average speed of 47.27 miles an hour When he descended darkness had fallen. For an hour before he landed it was necessary to light and maintain fires at different points along the course in order to guide this enduring aviator

With a 160 horse-power monoplane similar to Vedrines' Deperdussin (which was of but 140 horse-power) it would take only three fifths of the time that Fourny remained aloft to fly from New York to Chicago In other words, ten hours could be cut from the time required by our fastest express trains to run from one metropolis to the other The production of such a commercial machine is a comparatively simple matter In fact, Vedrines has stated that were he able to come to this country and remain here for a time, the first thing he would do would be to develop a commercial speed monoplane and start an air line for passenger traffic between the above mentioned cities.

After having constructed a powerful Blériot monoplane especially for quick climbing, Roland Garros succeeded, on September 6th in breaking all records for altitude In an hour and a half he rose to a height of 4,900 meters (16,076 feet) surpassing by 630 meters (2 067 feet) the previous record made by the Austrian army officer Blaschke. But Garros's enjoyment of his new record was not for long, as only five days later, the intrepid Legagneux who had previously done practically no high climbing in any way comparable with Garros's, reached the stupendous height of 17 880 feet (5,450 meters)—over 3½ miles in the exceedingly short time of 45 minutes, and dropped from far above the clouds to *terra firma* again in 10 minutes. He used a Morane-Saulnier monoplane and climbed the first 1,000 meters at the unheard of rate of over 1,300 feet per minute, or about fourteen miles an hour vertically—over three times as fast as any monoplane except Garros's had ever been known to climb before The climbing rate fell proportionately as the air became lighter and at the end of their ascents both aviators had to inhale oxygen. In Garros's case the gas gave out at 13,125 feet, and he climbed the remaining 2,951 feet without it. At the tremendous height attained by Legagneux—greater by 4,000 feet than that of Pike's Peak—the atmospheric pressure is only about half that obtaining at sea level. Not alone the aviator, but his motor as well, become starved for oxygen and it is surprising that the latter can develop enough power to reach so great an elevation Undoubtedly, by feeding oxygen to the motor as well as to the aviator, even greater heights can be attained.

Action of Shrimp on Tin

THE popular idea that only acid substances attack tin is wrong Fish, asparagus, beans, pumpkin and spinach are not acid and yet their corrosion of tin is quite marked. This is possibly due to [illegible] compounds, substances relating to [illegible]. In the case of shrimp, the cans are often eaten through in a comparatively short time. [illegible]

Electricity

Treatment of Sulphated Storage Battery Plates.—A new electrolytic method of regenerating accumulator plates that have been injured by "sulphating" is announced. The plates are immersed in a sodium sulphate solution, making an electrolytic cell through which current is passed, forming sodium hydroxide in the negative plates and sulphuric acid in the positives.

The Production and Consumption of Copper.—It is calculated that the consumption of copper runs parallel to that of iron, and statistics show that the world's use of the so-called "red metal" ranges from 334,565 tons for America (the chief consumer) down through Germany, Great Britain, France, Austria-Hungary, Russia and Italy to 42,000 tons "for other countries." The production has about tripled in the last twenty years.

New Plant for Making Aluminium.—Aluminium is to be turned out at the rate of 25,000 tons annually at a new hydro-electric manufactory now under construction in North Carolina. Power will be supplied by seven vertical water-wheel type electric generators of 5,000-kilowatt capacity, the largest ever built for generating direct current, together with several smaller machines. The enterprise has been financed in France and the work is in charge of Dr. R. Heroult. The plant will be the largest in the country, except one at Niagara Falls, and it will be completed by the middle of 1914.

Enamel as a Dielectric for Wireless Telephone Condensers.—A Japanese invention is announced designed to overcome the well-known electrical and mechanical difficulties experienced in the use of glass-plate condensers in wireless telegraphy, especially on board ship. Brush discharge at the edges of the glass plates, which is ordinarily reduced by varnishing at the edges of the plates, is more effectively checked by a flexible, non-splitting coating of enamel of high insulation resistance and dielectric strength. In Leyden jars the loss from brush discharge was reduced nearly 20 per cent by the use of the enamel.

Cadmium Alloy Vapor Light.—Many attempts have been made to improve the mercury vapor lamp, which gives a light of high electrical efficiency but is disadvantageous for some purposes on account of the greenish color of its light. A German inventor now announces two forms of metal-vapor lamp giving a white light by an alloy of cadmium with a small percentage of mercury. One form has a graphite anode and a mercury and cadmium cathode, and the other has both electrodes of the cadmium and mercury. The latter lamp is claimed to have an efficiency equal to that of the pure mercury vapor lamp. A peculiarity of the new lamp is that the active material, being solid at ordinary temperatures, becomes deposited on the walls of the quartz tube as the lamp cools after the current is turned off. This action gives no trouble, however, as the deposit is vaporized as soon as the current is switched on again.

Power Dissipating Rheostat.—The dissipation of large amounts of energy in electrical testing work by means of rheostats becomes a serious problem on account of the heat generated, and special means of cooling the rheostat must be provided. For testing a large storage battery at St. Louis, requiring the continuous dissipation of 1,500,000 watts of energy, the device was adopted of using iron pipe as the resistance conductor and of cooling the same by circulating water through the pipe. A total length of 369 feet of 2-inch pipe was used, made up into a grid which was tapped at several points to allow the water to escape without having to pass from end to end of the grid. In the use of this rheostat the 5,100-ampere discharge of the battery was satisfactorily dissipated during the rated one-hour discharge by 1,310 cubic feet of circulating water, although it was found necessary to quench local hot spots in the pipe by playing on them with a hose.

Load Dispatching on a Great Central Station System.—In certain large and complex electricity supply systems, where current generating capacity is so great that serious damage might easily follow a mistake in closing switches or in making feeder connections, a "load dispatcher" is employed. This official has in his office a large plug panel or board representing diagrammatically the entire generating and distribution system, every high tension (oil) switch, feeder and tie line being shown "in little" so that the dispatcher can follow out any given circuit easily and quickly. The pilot lamps on the oil switches (a red lamp for a closed switch and a green lamp for an open switch) are represented on this board by plugs with correspondingly colored heads, inserted in holes to indicate the actual condition of the switches at any moment. No switch is allowed to be operated at any station or substation without telephone instructions from the dispatcher, and upon the information and orders thus communicated, the plugs are inserted and withdrawn in the board. Thus the board shows the electrical condition of the entire system at a glance, thereby enormously facilitating the proper balancing of the load and the quick location and removal of trouble.

Science

The Cinematograph in German Schools.—The German Ministry of Education proposes to introduce the use of the cinematograph in various courses at institutions of higher education. Films for courses in anatomy biology and bacteriology are already available in Germany. A leading philanthropist has presented two fully equipped moving-picture machines to the schools of Berlin, one of which is to be used in the higher normal schools and the other in the high schools.

Schaumasse's Comet.—The new comet discovered by Schaumasse of Nice, France, on October 18th, was discovered independently by Dr. W. R. Brooks of Geneva, N. Y., on October 20th. A cablegram from Kiel states that Fayet and Schaumasse announce that the elements of the comet are nearly identical with those of Tuttle's comet, discovered January 4th, 1858, at Harvard College Observatory, and later shown to be identical with Mechain's comet, 1790, II Its period is about fourteen years. It was observed in 1871, 1885, and 1899.

British Gasoline Fire Tests.—The British Fire Prevention Committee, at the opening of its autumn session last month, carried out a highly important and interesting series of experiments with a foam extinguisher. The foam, which is created by chemical means, was thrown upon burning gasoline, ranging in quantity from a mere bucketful to a flooded basement in which fifty gallons had been spilled. The tests are said to have been highly satisfactory and were watched by representatives from the several government departments. Members of the military aviation department also were present

Rev. Walter William Skeat, who died on October 7th, was a tower of strength in English philology, and his place will not soon be filled. To the average man he is probably best known as the author of an Etymological English Dictionary, which is found in all libraries, but during his life of 77 years he produced a prodigious number of other valuable works, nearly all relating to the English language, past and present. He edited many old English texts, and he was the founder and first president of the English Dialect Society. From 1878 to the time of his death he was Professor of Anglo-Saxon at Cambridge University.

A Statue of Capt. James Cook, the navigator, the gift of the Hon. Gervase Beckett, M.P., to the town of Whitby, was unveiled at that place October 2nd. In referring to this event the English journal *Nature* reminds its readers of the fact that Cook earned the gratitude of the world not alone as an explorer, but also as the first person to take scientific preventive measures against scurvy on shipboard. In so doing he contributed greatly to the success of nautical explorers who came after him. When he returned from a three years' voyage in 1775, he had lost but one man in a crew of 118. This achievement earned him unanimous election as a fellow of the Royal Society.

Capt. Koch's Journey Across Greenland, the plans for which we have previously reported, was successfully begun during the past summer. A remarkable bit of preliminary training was carried out by the party, which while visiting Iceland in its ship, the "Godthaab," in order to procure Iceland ponies for the sledge journey, made a brilliant dash across the island, from south to north, scaling the highest point of the inland ice-cap, viz., Oræfajökull, a feat which had been accomplished only once before, by Lord Watts, in 1875. The party sailed north from Akureyri, Iceland, on July 6th, and effected an easy landing at Cape Bismarck, on the far north-eastern coast of Greenland, July 21st. This would have been impossible in the summer of 1911, when the ice conditions were very unfavorable. Capt. Koch expects to cross Greenland at its widest part, reaching the west coast some time next year He is accompanied by the German meteorologist, Dr. Alfred Wegener.

The Northeast Passage.—No less than three expeditions are now under way, or in preparation, with the object of making the Northeast Passage around the Arctic coasts of Eurasia; a feat that has not been accomplished since Nordenskjöld's successful journey of 1878-79 in the "Vega." Two of them have already been reported in these columns, viz., that of the two Russian ice-breakers, which were to sail from Vladivostok last summer, and the elaborate German expedition under Lieut. Schröder-Strange, which is to leave from the European side in June, 1913, and spend about four years in explorations *en route*. It is now stated in *Petermann's Mitteilungen* that a Russian expedition under Lieut. George Brussilov left St. Petersburg in July in the "St. Anna," which under the name "Pandora" was the vessel used by Sir Allen Young in his journey of 1875-76 in quest of traces of Sir John Franklin's expedition. Brussilov will follow the route taken by Nordenskjöld, and expects to reach Vladivostok in about a year and a half. The expedition proposes to winter at the mouth of one of the Siberian rivers; probably Khatanga. It is expected to defray part of the expenses of the expedition by hunting and fishing and by trade with the natives.

Automobile

Self-illuminating Car Paint.—The latest in automobile paints comes from England. One of the largest firms there has just brought out a new varnish, called "Lumino Aluminum Paint," and it is stated that the glow of the paint on a dark night is so bright that the car is visible for two miles, without being fitted with lamps. People on the roads near the factory at first were frightened to death by the strangely glowing, lightless cars, which silently skimmed through the village.

Eight Patents for Hinged Vehicle Hoods.—Traugott Golde has secured patents numbered from 1,034,899 to 1,034,906, inclusive, for hinged vehicle hoods comprising an arrangement of bows for supporting a hood or top of the automobile type in such manner that the tops are supported from the rear portion of a car and extend thence forwardly over the front seat In the earlier filed applications Mr. Golde appears as from Gera, Germany, while in the later applications his address is given as Passaic, N. J.

Armor-plated Cars for Italy.—The Milan automobile club has opened a subscription to provide the war department with armor-plated automobiles for the operations in the Tripoli region, and these are to be made according to a special design, carrying light cannon and also mitrailleuses. Engineer G. Galli has now gone to Tripoli in order to organize the automobile service, as there are now considerable funds received, so that it is expected that the armored cars will soon be crossing the desert, manned by the best officers of the engineer and artillery corps.

Handy Combination Lamp.—A combination automobile headlight and movable hand lamp has just been placed on the market. It consists of a silver-aluminium casting about 3/16 of an inch in thickness, ground on the inner surface to a mirror-like polish The socket of the electric lamp fits in the reflector in such a manner as to be easily removable by a simple turn of the socket to the left. The long flexible cord attached to the socket renders it available as a "trouble lamp" reaching to all parts of the car. The removable socket also permits of using variously powered bulbs for use in city and country driving.

Montreal Forbids Steam Trucks.—At a time when renewed effort is being concentrated on a sturdy powerful steam truck, which has been demonstrated in Detroit and in Nyack, N. Y, the city of Montreal, Can., is making an attempt to legislate the steam truck and tractor out of business. The city council has just passed an ordinance forbidding the use of steam-propelled commercial cars on the streets, but permits the driving of steam-propelled pleasure automobiles. The ordinance is particularly aimed at the huge steam tractors with their trailers, which are used in England and which are in evidence in the country districts of Eastern Canada.

Trouble With Initials.—Considerable trouble is experienced in Europe with the custom of abbreviating the extraordinarily long names of some of the cars, by using the initials only There is a S. C. A. R. car made in France, a S C A T in Italy, and a S. C. A. P. also made in France, the initials in each case representing "Société de Construction Automobile" (then follows the last word. Turino, Parisienne, or whatever it may be). The newspapers and magazines, especially, are "up in the air," frequently giving credit to the wrong car, and even perpetrating errors in the advertisements put out by the various companies.

How They Do It in Germany.—In educating police magistrates and prosecuting attorneys in the rudiments of automobile traffic requirements, so that they may be able to handle intelligently the many cases of traffic violations, the Berlin justices of the lower courts and their "Staatsanwaelte" were taken on a tour of the city in automobiles supplied by the Imperial and Berlin Automobile Clubs During this tour, which lasted several days, and which penetrated into every section of the big city, the cars were driven at all rates of speed and the passengers were given all opportunities to test in their own persons the effects of Berlin's traffic regulations.

Carbureter Attachment for Slow Engine Speeds.—An English firm has just brought out a carbureter attachment which will enable the chauffeur to keep the engine running, while the car is standing still, at an exceedingly small expense for gasoline The device consists of a small fitting, containing a minute jet and air inlet soldered to the inlet pipe, between carbureter and engine, and a small pipe connecting with the float chamber. An adjustable needle valve is supplied to adjust the quantity of gas and air required for slow and silent running. The action of the device is entirely automatic. On shutting the main throttle, the vacuum in the inlet pipe increases to such an extent that the small auxiliary jet comes into operation, the gas mixture being regulated by the position of the needle valve. When the throttle is opened again, the suction decreases and no gasoline is drawn up to the auxiliary jet, which is at a higher level than the main jet.

Electricity and Spray Irrigation

How Water May be Raised by Electric Pumps to Produce Artificial Rain

By Putnam A. Bates, E.E.

ELECTRICITY for lighting and power is rapidly advancing in the favor of the American farmer. Whether he be one of those adventurous individuals who stake their all on the prospect of developing a paying farm in the arid districts of the West and Southwest, or in the swamplands of the South, or whether he be of the class that is turning its attention to the great rewards of truck and dairy farming in the East, the modern farmer has caught the scientific spirit of the time and is getting practical results from his realization of the fact that methods must accommodate themselves to changing conditions.

At Bridgeton, New Jersey, Charles F. Seabrook is farming with twenty-five acres under irrigation, and he usually gets from three to four crops a year from each piece of ground. The crops raised are lettuce, celery, parsley, carrots, cabbage, beets, onions, leek, and practically every kind of truck a vegetable gardener would grow.

The method of irrigation which Mr. Seabrook employs is shown in Fig. 1. While not new, it is quite different from the methods with which we are more familiar, that have become so stamped upon the mind of many not especially posted as to lead them to regard water "ditches" and "irrigation" as indicating synonymous conditions. The idea is to reproduce a gentle rainfall, insuring uniform distribution of water, under control. The application of the water is in the form of a fine spray, which settles into the soil, and does not remain on the surface. The pipes run horizontally across the field six feet in the air and are fifty feet apart. Every four feet a nozzle is inserted in the pipe from which the water is ejected in a fine spray. This spray is so fine that it does not pack the soil as a heavy rain.

It is a noteworthy fact that for every pound of solid matter added to a plant by growth, it is necessary that several hundred pounds of water be taken up by the plant and evaporated through it into the atmosphere. That indicates the importance of the proper means of furnishing the water supply to the plant. With this fact in mind, it is impossible to understand the reason why the crops secured from proper irrigation yield results which seem unbelievable to many growers.

The difficulties encountered in many methods of irrigation are the initial cost of installation, the difficulty of securing a satisfactory uniformity of distribution, the waste of water and the excessive labor and expense involved in irrigation.

The most familiar method of irrigating a considerable area is the ditch system. In many localities the character of the soil renders the use of the system impossible but, wherever used, it is wasteful in the use of water. And with this system it is difficult to approach that uniformity of water distribution necessary to produce an equal growth on all parts of the acreage irrigated. The cost of labor involved in this method is high, and should a heavy rainfall follow the irrigating damage is apt to result. What is known as the deluge "system" is an overhead distribution system sometimes used, in which circular lawn sprinklers are located at regular distances over the field, the water being supplied to them by pipes. The objections to this method have been two-fold. First, it is impossible to secure a uniform distribution of the water, for the reason that between the circular areas watered by the sprinkler there exist dry spots which do not receive a sufficient amount of water. The second objection is that the water as applied to the ground has the same effect on the surface soil as does a heavy rainfall, resulting in heavy incrustation of the surface, interfering with the air supplied to the roots of the plant, thus retarding the growth, and necessitating additional cultivation. The expense of this system in its first installation is excessive and the results are unsatisfactory.

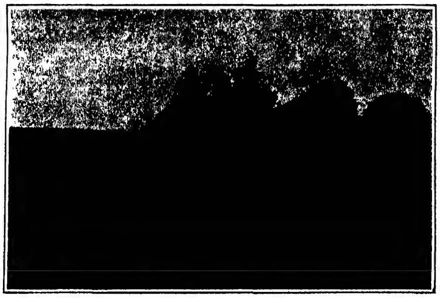


Fig. 1.—Irrigation in the form of an artificial shower.

On small areas the makeshift method of watering by hose is used with reasonably good results, but it is only a makeshift and requires too great a labor cost to be considered for anything more than a small patch.

It is impossible, therefore, to water uniformly and without materially disturbing the proper mechanical condition of the surface soil unless we follow a method the application of which will approach the conditions under which a gentle rain or mist will fall upon the ground. The method which is here shown accomplishes this, and it is without question beneficial in truck garden work or on other areas of fertile soil where the forcing of crop growth is undertaken.

In the kind of farming that is being taught to-day we must plan for a full crop every year—not every other year, or, every third or fourth year, as so often happens in the humid sections where the land is neither drained nor artificially watered, but where thirty to sixty-day droughts occur with considerable regularity.

There is so much comparatively inexpensive land surrounding all our large cities that it is well to lay stress on the methods by which such areas may be made more productive.

On a demonstration plot where the spray irrigation was employed an acre and a half of this farmer's strawberries yielded over $200 worth of fruit after non-irrigated ones in the same field had ceased to bear for the season.

Irrigated onions yielded at the rate of 482.8 bushels per acre, the bulbs taking first premium at the fair for quality. This onion crop received during its growth 3.04 inches of water by irrigation and 5.77 inches by rainfall. But the rainfall failed to do its duty, as the bulk of it came in one large cold storm and the balance in eleven small useless showers. Irrigated raspberries responded with a ten days' longer bearing season, and much more thrifty canes than non-irrigated vines. The manner in which the water shall be conveyed from its source-stream, pond or underground flow, to the distribution system adopted is a problem that merits as careful analysis as that applied to the question of spreading water upon land.

In any case pumping is an essential except where nature provides conditions of gravity flow. The usual gasoline engine-driven pumping equipment is shown in Fig. 2. Oftentimes it is necessary to use an internal combustion engine for irrigation pumping, but in the last analysis, where electricity is available the motor-driven pump offers, in ease of control and convenience of application, the best conditions yet devised.

Fig. 3 shows a small electric irrigation pump, and with such it is possible to introduce in the installation a storage tank under air pressure which will supply the water through the system of overhead sprayers at a desired "head," and at the same time the operation of the electric motor may be entirely automatic, no attention whatever being required for either stopping or starting. And from an entirely different point the water supply to the distribution system may be controlled or regulated according to the needs of the crops which are under irrigation. Lastly, on a basis of reasonable cost for electric current, pumping by means of this form of energy is cheaper than with any other.

Fig. 2.—Where electricity is out of the question a gasoline motor will pump water for irrigation.

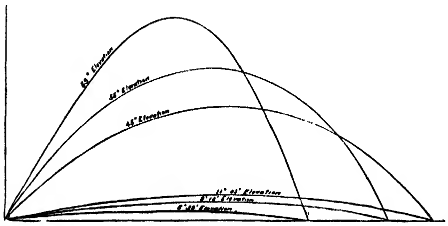
Fig. 3.—Combined electric motor and pump, controlled automatically or by switch at distant point.

Mortar Fire

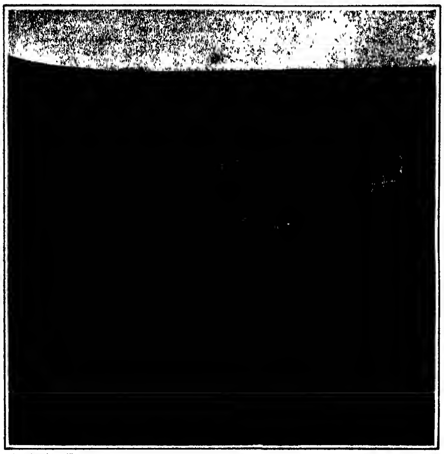
A System for Attacking the Decks of Battleships

By Charles A. Junken

FIRING directly at the side of a large wooden box at fifty yards, even a poor shot might expect a hit. On the other hand, an expert rifleman, with equal certainty, might expect to miss, firing in the air, in an effort to land on top of the box. In any event the latter method of attack would hardly appeal to a sportsman. Far better to try for an almost sure hit firing directly at the side of the box than to take chances on an equally sure miss in an attempt to hit the lid by firing in the air; and in so far as mere hitting is concerned no question can be raised as to the better method of attack. Suppose, however, that it is essential not only to hit, but perforate, the box which is now to be considered so far removed that a side sheathing of metal results in the flattening out of all bullets fired directly at it. The top and bottom of the box remaining unprotected, the lid offers the only hope of successful attack. The rifleman is thus forced to resort to a method known as "indirect" or "high angle" fire as the only chance of successful attack.

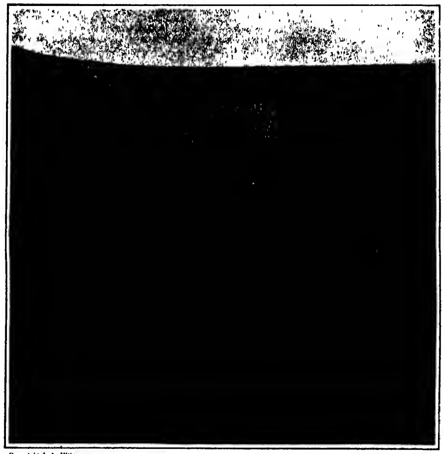


Relative angles of elevation and trajectories of shells from 12-inch rifles and mortars.



Copyright J. A. Wilson

Photograph, 1/5,000 second exposure, showing shell issuing from mortar. The white ring is gases that have escaped past projectile in the bore.

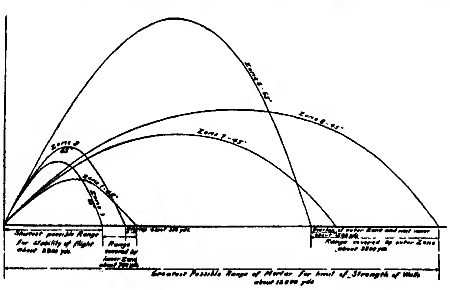


Copyright J. A. Wilson

The mushroom-like burst of gases from muzzle immediately after the shell has left the mortar. Taken an instant later than adjoining photo.

The box thus described is an illustration of the target presented by a modern battleship or heavily armored cruiser. In broadside this is so heavily sheathed with protecting armor as to be well nigh invulnerable, at even moderate ranges, to the attack of the most powerful modern "direct-fire" guns. In deck armor it is rather weak and entirely at the mercy of the "indirect" fire of a modern mortar. The relative thickness of side and deck armor is illustrated on the next page.

Because of the only remaining chance of successful attack the mortar advocate will obtain a most respectful hearing if he can but develop a tendency to hit. If it be required of him, he can plead the additional argument of economy. Owing to the weak deck armor he is called upon to perforate, his gun is short, for he requires but low velocity to attain long ranges. Projectiles are big because the walls of the mortar can be handily made thick and strong enough to withstand the pressures developed by the relatively small powder charge required to launch a big projectile to a considerable range, and the very fact that small charges of powder are required, makes for economy in every round. The relative sizes of guns, projectiles and powder charges are herewith illustrated. The ranging effect or distance of flight of any object launched in air, under similar conditions, depends entirely on the angle of elevation. The propellant force remaining constant and conditions normal, the range depends solely on the angle of elevation at which the given object is projected. This is alike true of a baseball thrown by an equally strong arm, a football punted by an equally strong leg, or a bullet of certain dimensions and weight propelled at equal velocity from a firearm. For any given set of conditions an angle of projection of about forty-four degrees and twenty minutes will result in the greatest possible range. Roughly speaking, this is an angle of forty five degrees, and this angle is adopted as the lower limit of elevation for mortar fire.



Zones of fire of mortar batteries.

Both above and below this angle of projection the range decreases till, on the one hand at dead level, and on the other at the vertical, the range becomes zero. This is illustrated in the paths of flight herewith shown. From the dead level or zero elevation to forty-five degrees, every possible range within the power of the firearm is attainable, and the same is equally true from forty-five degrees elevation to the vertical. But the theoretical possibilities thus developed are vastly prescribed in practice. As has been pointed out, direct-fire guns are limited to the range at which their projectiles can perforate heavy side armor. At the comparatively low angle of fifteen degrees this limitation is reached, even at normal impact, which is, of course, quite exceptional, since it means a flat broadside exposed to attack, which rarely happens.

At present writing it is well assured that the best armor-piercing shot fired from the most effective direct-fire gun is impotent on the present side armor at ranges consequent on angles of elevation about fifteen degrees. The velocity is so greatly reduced by the resistance of the air that the remaining momentum of the projectile merely serves to shatter it helplessly against the heavy side armor of the target. Direct fire has to-day a sure limitation

of fifteen degrees, and will have for some time to come. The limiting angle for indirect fire or mortar fire is likewise restricted, but from a very different cause.

At angles of elevation above sixty-five degrees the time of flight becomes so great as to be prohibitive, and this marks the limit for the highest angle of mortar fire There are other considerations involved in the strength of carriage and irregularities of flight above this angle, but these are subordinate to the unavoidable objection of excessive time of flight.

Of course, it is understood that to make a hit, it is essential that moving target and flying projectile arrive at the same spot at the same instant. In firing at a maneuvering battleship the element of time of flight thus becomes a most important factor, and it will be readily admitted that the time the projectile is in the air should not exceed one minute By changing course and rate of speed, the commander of a maneuvering ship, in such a long interval of time as this, can readily place her at other than the predicted or anticipated point where she is expected to be when the shot strikes. This limit points, at the outer range, to an angle of projection not exceeding sixty-five degrees, since at this angle it takes the projectile over a minute to perform its path of flight.

It is a peculiar coincidence that with limiting restrictions so widely divergent, the scope of angles of projection is about the same. The total change in elevation for direct fire is limited to fifteen degrees, and that for mortar fire to twenty degrees. These limitations of the upper angle thus prescribed place a great restriction on the attaina range. On this account it has been necessary to resort in mortar fire to what are called "zones" It is, of course, essential to cover every yard of range between the outermost and innermost limits of fire.

At a maximum velocity, within the power of the gun, behind a given projectile, the maximum range is attained at forty-five degrees, but the minimum is not attained at sixty-five degrees The only way to get less range after this angle is arrived at is either to reduce the powder charge or increase the weight of the projectile, or both.

Since the longest ranges are of little value, on account of the inherent inaccuracies, it was decided in Uncle Sam's service to build a mortar only strong enough to carry the heaviest projectiles to moderate ranges. A comparatively light projectile was designed for the outermost zone. With this projectile a certain portion of the total range is covered. The limits of this lighter projectile of 824 pounds weight are between a maximum of about 12,000 yards for forty-five degrees, to a minimum of about 8,700 yards at sixty-five degrees elevation

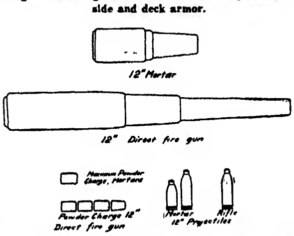
An approaching battleship is fired upon by mortars at the outermost range, and finally arrives at safe anchorage on account of the limiting angle of sixty-five degrees elevation, which results in the shortest possible range for the mortar under the restriction formerly adverted to. Alive to this situation, the mortar man employs a heavier projectile of 1,046 pounds weight, the same as that used in a 12-inch direct-fire gun; and so reduces his powder charge as to attain the same or but slightly greater range at his best angle of forty-five degrees with this projectile than was previously attained at sixty-five degrees elevation with the lighter one. He thus establishes a second zone of fire that will last him till the enemy once more arrives at the angle of safe anchorage, as it may be called, of sixty five degrees Once again the powder charge is reduced so that the angle of forty-five degrees will result in range but little greater than was previously attained at sixty-five degrees So on, by successive reductions of charge, the range is shortened with successive zones of fire till the minimum limit is reached.

The limiting range is for an angle of sixty-five degrees with the smallest powder charge that will result in stability of flight. Stability of flight means that in spite of the low limit of velocity and the limiting twist of the rifling of the bore of the mortar, for high velocity, the gyroscopic action of the elongated projectile shall still be sufficient to keep it steady in flight.

The wobbling of a spinning top that is dying out is an illustration of the effect that a too low velocity might have on a projectile fired from a gun. There is danger of the projectile "tumbling."

To give the mortar crew time to change the powder charge from one zone to the next, a certain "overlap" of zones is provided. The next lower powder charge is so prescribed that at forty-five degrees elevation the range will be somewhat greater than the charge next above at sixty-five degrees. To meet all these requirements, eight zones of fire are prescribed and the conditions met are herewith illustrated.

Diagram showing relative thickness and position of side and deck armor.



Relative sizes of direct and indirect-fire guns, powder charges and shells.

With such complications involved, and in consideration of the fact that the mortar crew is hid behind protecting parapets and does not even see the moving target attacked, results are marvelous. A mortar crew in recent firings obtained seven hits in eight shots at a range approximately 10,000 yards, or nearly six miles. That all difficulties have been met and overcome, in the construction of a range table and adequate method of correction for abnormal conditions of atmosphere, wind, and travel of the target, that will give a mortar crew a fair chance of a hit, is an achievement in which the servants of Uncle Sam, who are responsible for this accomplishment, find a solid degree of satisfaction. In no foreign country has so great a measure of success been attained by the methods of mortar fire.

The accompanying photographs are most interesting illustrations of firing by methods of direct and indirect fire. The principal interest attaches, however, to those in which the projectiles have been caught in flight. In the direct-fire picture the projectile is plainly visible, just beyond the expanding gases of combustion, flying forward at the slight angle of elevation requisite to give it the long range it will attain before it strikes. The mortar projectile is shown at the instant before its exit from the bore. The clouded ring that partially envelops the projectile is the result of a slight escape of gas beyond the projectile before it was fairly seated in the rifling of the bore. The next photograph shows what happened an instant later in a later round.

These photographs were recently taken under the supervision of the Department of Enlisted Specialists, Coast Artillery School, Fort Monroe, Va. The camera is actuated electrically, by means of the projectile in the case of direct-fire guns, and by the recoil of the top carriage in the case of mortars. Time exposure in both cases was about one five thousandth part of a second. These photographs are copyrighted and permissions to use the same for this article was obtained.

New York State Education Building

By J. A. Stewart

THE beautiful State Education Building, dedicated at Albany, N. Y., last month, is the only edifice of its kind in this country or abroad. It is of classical design, built in white marble, terra cotta, and dark granite. The façade consists of a Grecian marble colonnade resting upon a proper and powerful granite stylobate. This huge marble colonnade stands out well from a wall pierced by a series of large semi-circular openings which allow great window area and produce a secondary architectural effect. The colonnade supports a beautiful attic and cornice. The roof is of copper, the eaves being decorated by a carved chenau. The rear walls are of light-colored vitreous brick and terra cotta. A fine flight of granite steps leads to the main entrance at the center of the building, which is placed about 50 feet back from the sidewalk to permit of landscape decoration.

The State Education Department occupies the first floor. The State library is located on the second floor. Various educational divisions, including the examinations, and educational extension divisions, and the library school find place on the third floor.

The State museum is allotted ample space on the fourth floor. Here in rooms lighted from above, are adequately housed the scientific collections of the State. The New York State Museum is one of the oldest public scientific museums in America, and it has the largest scientific collection belonging to any State in the Union. These collections, previously scattered through five buildings, are in many respects unequaled. Previous to the opening of the new museum scientific specimens of all kinds were stored away in many hundreds of boxes and cases, some of which had not been opened in half a century.

The principal room of the new museum is 570 feet long, 50 feet high and 54 feet wide. It is subdivided into sections, and is one of the most spacious museum rooms in the United States.

The library reading rooms are very large. There is an enormous stack room for 2,000,000 volumes. A novel feature of the library is the introduction of stack rooms in the center of the building, for easy access. The general reference room has stone walls and is lighted by eleven large leaded glass windows. Its dimensions are 106 by 130, the ceiling being 50 feet high.

The basement contains the big safety vault, 15 feet by 43 feet, for the keeping of valuable documents. Within this is a small vault of special construction which is used for the storage of the "Emancipation Proclamation," Washington's Farewell Address, the André papers, the King Charles II Charter, the Washington relics, etc. Large fans for forcing fresh air to all the offices are provided in the basement. There is also a complete vacuum cleaning system.

The entire cost of the building was three and one half million dollars, the site costing nearly half a million more. The space provided is 11,348,850 cubic feet, as compared with 14,475,000 cubic feet of space within the State Capitol building, and this great area is expected fully to meet the requirements of the numerous scientific and library features above mentioned.

New York State Education Building at Albany.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Domestic Dough Kneader

To the Editor of the SCIENTIFIC AMERICAN:

Seeing in your number for July 13th, page 41, Notes for Inventors, "Wanted, a Domestic Dough Kneader," you have it now. We all have it in domestic service, in the form of a meat chopper (cutting meat by revolving blades). If a stiff biscuit dough is run through this three or four times, it is well worked and makes the bread that you might obtain by use of the old-fashioned fluted roller or the more ancient method of beating the dough with a hatchet or hand ax for thirty minutes.

Charlottesville, Va. A SUBSCRIBER.

Railway Rails and High Speed

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 10th, under "Engineering," referring to the subject, "Reduce Railway Speed," in which the decision is "Too fast for safety," and the remedy suggested is "More metal in the rail base," your reply is that "both points of view are correct," and farther on, that "the sole requirement is a heavier and better rail."

Kindly permit me to disagree with all of the above and get down to the real and acknowledged cause of almost every broken rail. It is the piston, main-rod, side-rod, and counterbalance hammer-blow of the hundred-ton locomotive. I contend that any rail that will bear transportation and the necessary rough handling is competent to carry faster trains and heavier locomotives, *by simply taking the hammer-blow out of the locomotive.*

St. Louis, Mo. GEORGE J. FERGUSON.

Gasifying Coal at the Mine

To the Editor of the SCIENTIFIC AMERICAN:

In the September 21st, 1912, number of the SCIENTIFIC AMERICAN (cvii, No. 12), page 241, is an interview with Sir William Ramsay by Paul F. Mottelay, on "Gas-power Direct from the Coal Pit." It is mentioned therein that recently "Ramsay made the first public reference to his projected power scheme," which is based upon the possibility of burning coal in the depths of the earth to produce gas, which is then conveyed by pipe to engines in a power house on the surface. I beg to direct your attention to the fact that this is claimed in English patent 21,074, of September 22nd, 1909, issued to A. G. Betts, of Troy, N. Y. The process of Betts for utilizing unmined coal consists in gasifying the fuel as it lies in the seam in a similar manner to that in which it is gasified in a gas-producer; shafts are sunk, boreholes made, a fire started, and air and steam supplied. Betts describes a number of methods of working in his claims.

New York city. W. A. HAMOR.

The Bureau of Chemistry

To the Editor of the SCIENTIFIC AMERICAN:

I inclose some notices of judgment in pure-food law cases, apropos of some correspondence noted in your columns.

The fines are always so absurdly small that they have no deterrent effect whatever. The unreasonable delay in publishing these notices makes it impossible for the trade press to notice them. A case which was ended ten months ago is too ancient for notice. It certainly looks as though deliberate effort were being made to stifle the law in the courts and by the judges of the Federal bench.

This sounds absurd, but the notices I inclose are not unusual. They are just the ordinary run.

San Francisco, Cal. A. CROFTON.

[The notices referred to by our correspondent are the following:

Notice of judgment 1605, entitled "Adulteration and Misbranding of Lemon Flavor." "On February 13th, 1912," the notice ends almost apologetically, "the defendant entered a plea of guilty and was fined $100 and costs, this being a second offense."

Notice of judgment 1606, entitled "Adulteration and Misbranding of So-called Castor Oil." The last sentence of the notice reads: "On February 13th, 1912, the defendant corporation entered a plea of guilty, and the court imposed a fine of $10 and costs." Fines of this amount for manufacturing firms amount only to a small license.

Notice of judgment 1604, entitled "Adulteration of Oysters in Shell." No fine was imposed. The notice does not even mention the name of the shippers. The report was not issued until six months after final action.

Notice of judgment 1607, entitled "Adulteration of Tomato Pulp," states: "On March 1st, 1912, no claimant having appeared for the property, judgment of condemnation and forfeiture was entered, and it was further ordered that the products covered by all libels should be destroyed by the United States Marshal and that the barrels containing the same should be sold." In the opinion of our correspondent, "such judgments make a farce of the law. They say in effect: 'If you get caught, you lose that particular shipment. That's all.' "

Notice of judgment 1600, entitled "Adulteration and Misbranding of Highland Brand Tomato Catsup; Misbranding of Compound Glucose Apple Jelly; Adulteration of Waldorf Brand Tomato Catsup." The notice comments upon the filthy and decomposed condition of the shipment. "On March 19th, 1912, the defendant company appeared in court and entered a plea of *nolo contendere*, whereupon a fine of $1 was imposed in each of the three cases, with costs." Our correspondent naturally asks: "What end will be served by a $1 fine?"

Notice of judgment 1603, entitled: "Adulteration and Misbranding of Frutena." In this case the Acting Secretary of Agriculture decided: "On February 13th, 1912, decree of condemnation and forfeiture was entered, and it was further ordered, upon presentation of a bond in conformity with section 10 of the Act, and payment of costs, that the shipments be released and delivered to claimants." The name of claimants is not shown.

Notice of judgment 1602, entitled: "Misbranding of Salad Oil; Adulteration and Misbranding of Vanilla Flavor." The decision reads: "On January 5th, 1912, the defendants entered a plea of guilty, and they were sentenced to pay a fine of $25 on each of three counts, namely, misbranding of salad oil, adulteration of vanilla flavor, and misbranding of vanilla flavor, and costs taxed at $25.26." This, in the opinion of our correspondent, is another typical fine. "The length of time elapsing between the date of judgment and the issuance of the notice," he states, "is seldom less than seven months—sometimes a year. This kills publicity in the trade journals, which would record cases otherwise."

We publish the foregoing letter and the comments thereto (emanating from the writer of the letter) merely that all sides of the administration of the Pure Food and Drugs Act may be considered. The SCIENTIFIC AMERICAN is concerned chiefly with the scientific work required to administer the law effectively. It has no doubt but there are legal difficulties in the way, as well as scientific incompetence in the Bureau of Chemistry.—EDITOR.]

The Mississippi River Problem

To the Editor of the SCIENTIFIC AMERICAN:

The platforms of both the principal political parties declare for such measures as may be found necessary to prevent disastrous floods in the Mississippi River.

Any work in this direction by the general government must be preceded by legislation; legislation should be preceded by intelligent understanding of the situation; when the facts are generally comprehended, the merits of any proposed measure can be weighed and the best adopted.

It is a fact that the plane of flood height of the lower Mississippi is certainly increasing; the proof is found in the increased heights of levees now necessary over those of a short decade. For instance, the North Protection levee in Carrollton bend previous to 1890 was nine feet above the surrounding land; in 1893 the high water reached the top of the levee, since then it has been raised to eighteen feet; the recent high water of this year reached within five and one half feet of the top of this levee, notwithstanding numerous breaks in the levees above.

The causes of the steady increase in flood heights are: the clearing of forests and increasing areas of land in cultivation; the reclamation and ditching of vast areas of swamp lands; the cramping of the capacity of the river bed by the building of levees; the natural tendency of the river bed to slowly rise. These conditions may be expected to continue.

The underlying fact is, that more water is forced into the lower Mississippi, at times, than it is able to deliver to the Gulf.

Strictly speaking, the Mississippi River flows into an estuary of the Gulf of Mexico which extends inland to the mouth of Red River.

When the silt-laden waters of the Mississippi flow into this estuary, there begins a precipitation of the silt. Before the construction of the jetties this silt was finally deposited at the entrance of the estuary and formed bars that were an obstruction to navigation, the removal of which led to the building of the jetties, which are but a narrowing of the channel to induce a current to carry the silt out into the Gulf. It will be apparent from this that the reach of the Mississippi, below the mouth of Red River, needs and must have an active current to maintain the present depth of water through it and through the jetties. It follows then that any plan for the diversion of waters from the Mississippi should not interfere with the normal flow needed below the Red River.

By act of Congress approved June 25th, 1910, the Mississippi River Commission was directed to investigate as to the "necessity, urgency, and practicability of permanently separating the waters of the Red and the Atchafalaya rivers from those of the Mississippi River."

This is the first step in the direction of diverting water from flowing into the Mississippi, and will undoubtedly afford some relief to the section below the mouth of Red River, which is the real danger spot of the problem; at the same time it is in the line of preventing the Mississippi from making a new route to the Gulf *via* the Atchafalaya River.

The writer believes that it is practicable to relieve the entire valley, from Cairo down, from destructive floods by utilizing a natural drainage channel that parallels the Mississippi on the west.

At a point on the Mississippi about fifty miles above Cairo and immediately below Cape Girardeau, Mo., the head-water tributaries of the St. Francis River are but ten to fifteen miles distant, with no physical or topographical obstacles to the construction of a drainage canal to draw from the Mississippi a portion of its flood waters.

There is at hand an inexhaustible supply of stone to make the intake impregnable at a minimum cost.

The flow from this canal would be into one of the tributaries of the St. Francis, where it would end; its control would then be assured by the building of low levees placed far enough apart to provide the area needed without exceeding five feet in height; in fact, through the "Sunken Lands" district of Missouri and swamps of Arkansas the levees might be placed as far as ten miles or more apart, thus impounding considerable bodies of water to drain off slowly.

From the St. Francis a canal of twenty-five miles would connect with the White River. This canal need be no wider than the St. Francis, nor deeper, at the intake, than to add a percentage of its flood waters, the control of all being secured by the line of low levees. From the White River a canal of ten miles would connect with the Arkansas River at a point where a canal of about fifteen miles would connect with the headwaters of Bayou Bartholomew. Where Bayou Bartholomew empties into the Ouachita River the distance to connect with the Castor or Little River is about thirty miles, but by following down the Ouachita seventy-five miles, the distance is but ten miles. The Little River through its connections flows into Catahoula Lake, thence into Red River.

From Red River to the Gulf, choice could be made of various routes. Louisiana, between Red River and the Gulf, is a network of bayous and streams that lead to tide water. The construction of a special waterway to flow into either Grand Lake or Vermillion Bay would not be an expensive proposition.

The entire distance from the head of the first canal on the Mississippi to Red River is through low-lying lands subject to overflow from local streams, there being but a small percentage under cultivation.

The net result of the plan thus outlined would be the diversion of a portion, if not all, of the flood heights of the Mississippi above Cairo, the St. Francis, White and Arkansas rivers, without affecting their *régime* at ordinary stages. The natural conditions permit the placing of levees far enough apart to provide for the volume of water without building them to exceed five feet high.

An outlet from the Mississippi cannot be attempted anywhere below the mouth of the Ohio, through the light alluvial soil, without risk of inviting the entire river to change its channel.

The diversion suggested in this article begins at a point on the river above the mouth of the Ohio, where conditions of soil and proximity of stone make it safe to draw from the Mississippi all, or a portion, of its flood water; the streams flowing toward the Gulf supply the directing channel and slope of bottom; the short canals needed to connect and make continuous the system are inexpensive to build; it will cost less to build new levees five feet high than to raise the old ones two feet.

There is another possibility in the line of diversion, where the Tennessee River touches the northeast corner of the State of Mississippi, it is but about twenty miles to the watershed that empties into the Gulf through the Tombigbee River, its connections, and Mobile Bay.

An inexpensive survey would determine the practicability of diverting the flood waters of the Tennessee River, which would help reduce the flood height at Cairo and the entire valley below.

It is a serious question whether or not the levees on the lower Mississippi should be made higher. The high water of this year flowed over the tops of many of them two to three feet. From past experience it would seem that the limit of height has been now reached, with some levees twenty-three feet above the surrounding land.

An example of what dependence on high levees may lead to is found in the disaster on the Yellow River in China in 1852, when the floods broke the levees, made a new channel to the sea, with its mouth six hundred miles from the old one.

The time is here, right now, when a choice must be made between some system of diversion or higher levees. The Mississippi River problem must be solved correctly and quickly or the lower valley will retrograde in population and progress.

Chester, Miss. SAMUEL L. YOUNTES.

Aerodynamic Experiments of Duc de Guiche

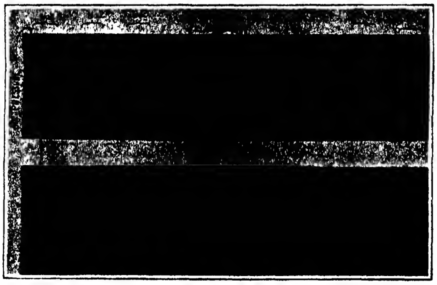
By the Paris Correspondent of the Scientific American

THE possession of accurate scientific data as to wind pressure upon plane surfaces is of inestimable value to designers of aeroplanes or airships. Such data are, however, very difficult to obtain, and up to the present but few experimenters have ventured to undertake the work. On this account the researches which have been made in France by Duc de Guiche are of great interest, the more so as he employs surfaces mounted on an automobile so as to approach very nearly the conditions which occur in actual practice. Heretofore most experiments of the kind have been made in the laboratory. What he desires to obtain is not the total pressure on a given surface, but the pressures at different points, as it is well known that such pressures are quite different at the edges and the middle of the plate. The present experiments were carried out in the forests of Villefermoy, near Paris, on a specially prepared stretch of road, over which the automobile carrying the apparatus was run.

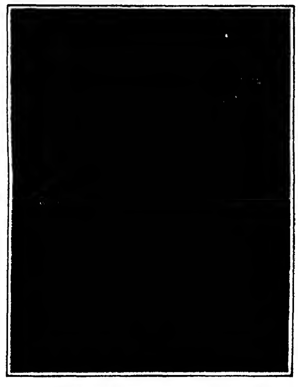
The road was treated with tar for a stretch of 300 feet so as to avoid deterioration and to keep dust out of the apparatus. Stretched across the road 10 meters (32.8 feet) apart were two rubber tubes, so that the wheels of the automobile could run over each tube in turn and give a record by compressing the air in the tubes. These latter were closed at one end, while the other end communicated with the recording device in a small cabin at the side of the road. Both tubes were joined to a Marey capsule or pressure indicator in which the air pressure causes a diaphragm to expand, and the needle on the diaphragm makes a mark on a sheet of smoked paper carried on a rotating cylinder. With the cylinder rotating at a given speed by clockwork, the distance between the two marks on the cylinder produced by the passage of the wheels over the two tubes thus shows the speed of the automobile. A tuning fork is mounted so as to record its vibration continuously on the cylinder in the form of small waves, so that by counting the number of waves lying between the two notches produced by the diaphragm needle we have the speed very closely, knowing the number of vibrations per second of the tuning fork and the distance between the rubber tubes. The rear wheels of the automobile also make records in the same way as well as the front wheels, and these can be used as a check on the first set. In the experiments the automobile was started at 300 to 2,000 feet back of the tubes so as to reach a constant speed at the point where the record was made. The plane surface to be tested had to be accurately flat, otherwise there would be errors in the experiment. The surfaces were made true to within 0.002 inch. The plates were made of wood braced with metal or in other cases of aluminium. The wood plates had a length of spread of 4 feet 5 inches and a width of 2 to 3 feet from front to rear, with a thickness of 0.6 inch. The aluminium plate was 2 feet 8 inches square and 0.32 inch thick in one case. Other sizes of plates were also used. In all cases they were mounted over the front part of the automobile upon light and strong supports of angle iron and the plates could be adjusted at any angle by swinging on pivots, the angle being measured by a graduated sector at one side.

When the automobile is running on the road, it might be feared that its movement would cause disturbances in the air which would be felt upon the plane surface and thus cause errors in the experiments. To this end the automobile was made as flat as possible and all precautions were taken to have it give but little disturbance. The test plate was mounted at a height of 4 feet 4 inches above the plane surface which covered the hood, and this latter was 4 feet 6 inches from the ground. A light silk ribbon streamer was mounted in the space between the test plate and

(Concluded on page 375.)



Two photographs of the pressure gages.



Determining the speed of the car.

Launching of the Battleship "New York"

First Ship of U. S. Navy to Mount the 14-inch Gun

THERE was launched on October 30th at the New York Navy Yard, the "New York," a battleship which marks a decided step forward in the development of the fighting power of our Navy. The ship takes over the name formerly held by the first of our armored cruisers, the famous "New York," which served as the flagship of Admiral Sampson during the Spanish War.

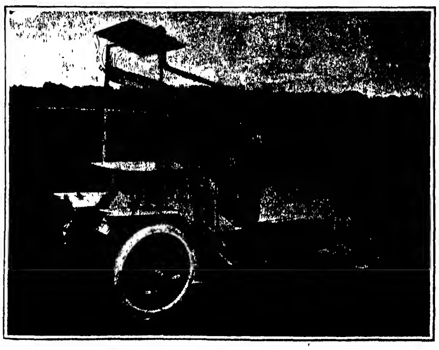
Those who were present at the recent review in the Hudson River were much impressed with the "Wyoming" and the "Arkansas," the latest and largest ships of our Navy present on that occasion. These vessels are 562 feet in length over all, of 26,000 tons normal displacement, and they carry a main battery of twelve 12-inch, 50-caliber guns. The "New York" and her sister ship, the "Texas," which was built at Newport News, are 573 feet in length over all and of 27,000 tons displacement, and their battery consists of ten 45-caliber 14-inch guns, carried in five two-gun turrets.

The "New York" is the third battleship of our new navy to be constructed at the New York Yard in Brooklyn. The first of these was the "Connecticut," now flagship of the Atlantic Fleet; the second was the "Florida," now in active commission in that fleet, and the "New York," which left the building ways on the morning of October 30th, is the third and by far the largest of the three, the respective displacements being, "Connecticut," 16,000 tons; "Florida," 21,825 tons; and "New York," 27,000 tons.

The keel of the New York was laid September 11th, 1911, and in the period of practically 14 months which has elapsed since that date, over ten thousand tons of material have been built into the ship, this being her launching weight. This fine ship has been constructed under the immediate supervision of Naval Constructor John E. Bailey, to whose energetic supervision and the zeal and hearty co-operation of the excellent working force of the yard, are to be attributed the early completion of this ship and the high character of the work which has gone into her. The ships built at the New York Navy Yard are proverbial for the thorough character of their construction, as witness the excellent record of the "Connecticut" and the "Florida." Although no one is prepared to deny that Navy Yard ships cost more than those built by private contractors, it is a question whether the high character of the work done and the reliability of the ships in service, to say nothing of the permanent retention at the yard of a highly skilled force of mechanics, do not fully compensate the nation for the extra outlay.

The recent ships built for the first line of defense of our Navy have the great advantage that in their main characteristics they greatly resemble each other. Each vessel is an enlargement and an improvement of the one that preceded it; there is no such bewildering diversity of design as characterizes—or until recently did characterize—some of the foreign navies. Thus the "New York" is an enlarged "Wyoming;" the "Wyoming" an enlarged "Florida;" the "Florida" a growth in natural and proper sequence from the "North

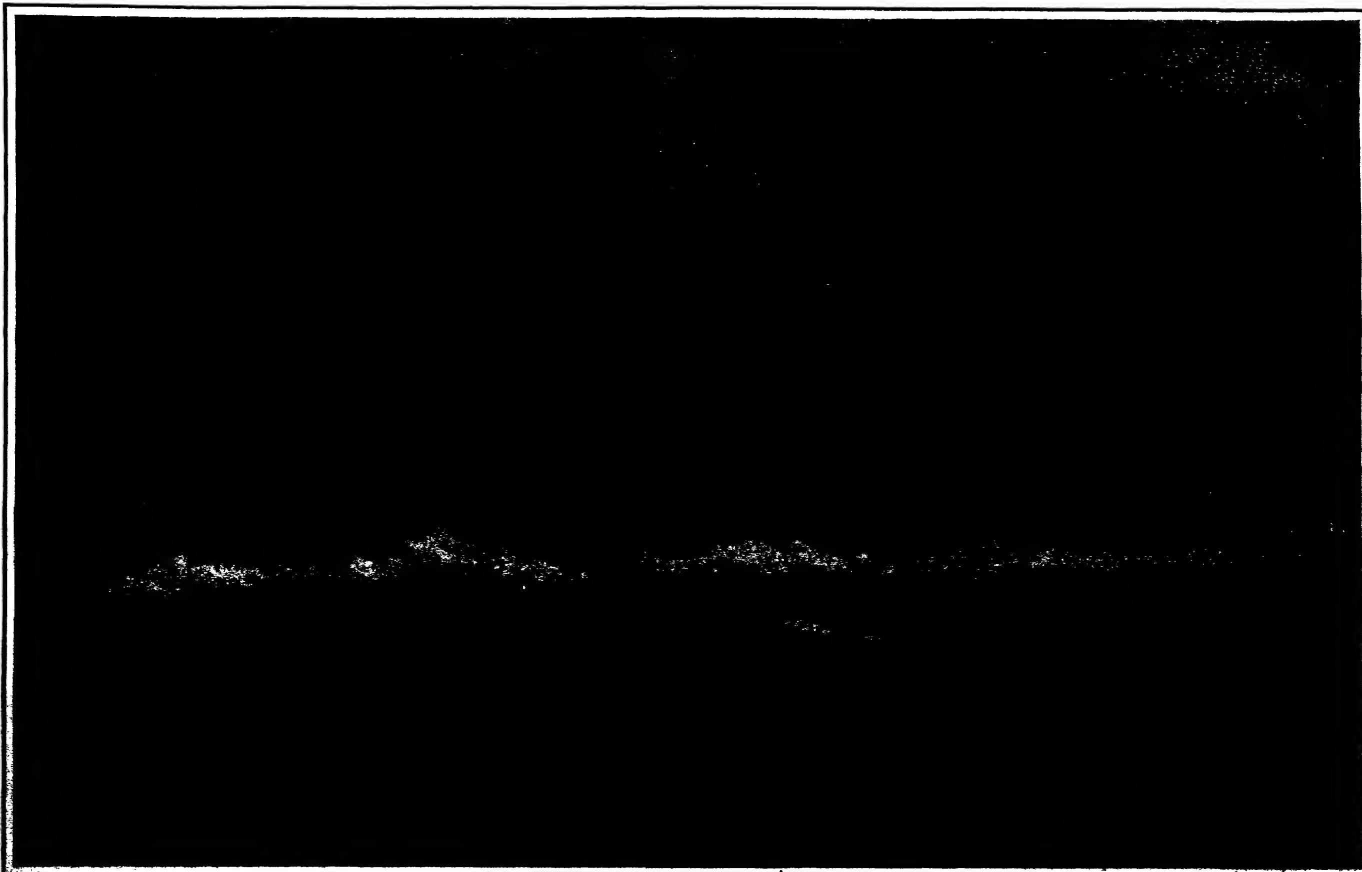
(Concluded on page 375.)



How the plane is carried above the car.

Mounting of the gage box and camera.

MEASURING AIR PRESSURES ON PLANES



Length, 573 feet. **Beam**, 95 feet 2½ inches. **Mean Draft**, 28 feet 6 inches. **Displacement**, 27,000 tons. **Speed**, 21 knots. **Coal**, 2,850 tons. **Oil**, 380 tons. **Armor:** Belt, 12 inches; gun positions, 12 inches. **Armament:** Ten 14-inch and twenty-one 5-inch guns. **Torpedoes**, four 21-inch. **Complement**, 1,070 officers and men. Launched at New York, October 30th, 1912.

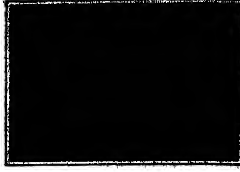
"NEW YORK"—OUR FIRST BATTLESHIP TO CARRY 14-INCH GUNS

The Bushmen of Africa

Their Paintings and Etchings

By W. E. Gardner

(Photographs supplied by Dr. Elmore)



TO the greater portion of the civilized world, South Africa is a land of mystery; a sealed book. But to those born in it, and to others who have gone to it to make it their home, it is a land of fascinating interest. It is at once one of the oldest and one of the most wonderful countries of the globe. Of comparatively recent years it has been known chiefly for its vast quantities of gold and diamonds, but its main interest attaches not to these two great sources of wealth. Throughout its mighty length and breadth, Africa conceals historical secrets the antiquity of which reaches back to times when the human race was in the very cradle of its evolution.

To explorers of the Dark Continent, one of the most interesting phenomena has been the commonness of what are known as Bushmen paintings. They are found throughout the sub-continent. In the various caves and natural shelters occupied in their wanderings by nomadic Bushmen are to be seen to this day, in a wonderful state of preservation, their crude paintings on the faces of the rocks.

Investigation traces the Bushmen back to the Paleolithic Stone Age, and their direct descendants are to-day met with principally in the dense-forest dwellers of Central Africa, though also in isolated instances in the Cape Colony. They have, through non-intermarriage, preserved the purity of their race - but at the cost of remaining one of the most retrograde among the native tribes. They continue to dwell in the caves and rock fissures in the same primitive state as their ancestors of thousands of years ago; and even their chief weapons still are the little bows and arrows (the latter made infallibly deadly with the venom of snakes) such as their progenitors of remote ages used.

The Bushmen were undoubtedly the aboriginal inhabitants of this country. After Dr. Phillip started a mission at Loverburg, in 1814, these people, who had been living by plunder, soon learned to be self-supporting, and when it was abandoned (by command of the Governor at that time) they degenerated again into barbarism. This fact proves that had the Bushmen been properly treated there would have been no reprisals on their part, for during the three years of the mission no depredations at all were committed by them. When, however, their game was driven away and their fountains were confiscated by the Boers, there was nothing left for them but to steal the flocks and herds to enable them to exist.

As stated, game constituted their main food supply, which circumstance accounts in all probability for practically the whole of their paintings depicting incidents of the chase. It should, however, be mentioned that some of the subjects are supposed to represent religious ideas. Indeed, there can be no doubt that a considerable number of the paintings illustrate Bushmen mythology, and this being so, they must be regarded as something vastly more expressive than mere daubs executed for amusement's sake alone. To their authors they conveyed a distinct and definite purpose.

It will no doubt interest Americans to learn that one of their countrymen, Dr. J. L. Elmore, of Kansas City, Missouri, for some considerable time has been making a close study of Bushmen paintings, and when his investigations are concluded he will not only rank prominent among the foremost authorities on the subject, but he will also be the possessor of one of the most complete and most accurate, if not the finest, collection extant of these curious works of art. The next best collection will be that in the custody of the Port Elizabeth Museum, South Africa, Dr. Elmore having, at the cost of infinite labor and time, reproduced in true detail and color an entire set of his own tracings which he generously donated to that institution. One of them is fourteen feet in length. Dr. Elmore's collection will, however, excel that of the museum inasmuch as he, being the possessor of over two hundred different and separate drawings, can copy any number and effect exchanges with other collectors.

For twenty years Dr. Elmore's tours have taken him beyond the Victoria Falls; he has tarried among the Matoppos—the resting place of Cecil Rhodes; Rhodesia, Matabeleland, Mashonaland, and in the West, Zululand and the Garden colony of Natal; while there is hardly a square mile of the Cape, Orange Free State and the Transvaal that he has not traveled. His inquiries into natural history have been extremely varied. He has succeeded in getting two thousand specimens of butterflies, which he presented to an American museum. The ophidia have also claimed his interest, and he prepared gratuitously for the Durban Museum the skeleton of a Natal rock python, the task occupying him eighteen months. During the last two years he has given his study to Bushmen paintings and Kaffir folk-lore in all parts of the country, as well as to native manners and customs. In these last investigations he has enjoyed exceptional facilities by reason of the fact that he has had access to all the literature concerning the aboriginal and native tribes since 1870.

In Bushmen paintings it has been stated that the subjects chosen by the primitive artists were mainly game; and the now fast-dying eland, one of the largest and most beautiful of the African antelopes, was the animal specially favored by them. By the courtesy of Dr. Elmore I am enabled to supply the SCIENTIFIC AMERICAN with photographs of the paintings for reproduction, but they lose considerably by having to be printed in the ordinary black and white instead of in the quaint tints found in the originals. The colors in which the paintings have so far been discovered are red, yellow, blue, brown, black and white, and Dr. Elmore is convinced that they are the natural oxides. At Post Catherine, beneath some paintings, he found a natural pocket of color. It was the pigment of the rock; a beautiful yellow than which a superior cannot even now be made. On taking a little on the finger-nail and comparing it with a picture, the doctor found the tint to be exactly similar. At another place some other oxide that had weathered off the rock was seen and proved on examination to be as fine a powder as the most perfect grinding machinery of the present time could produce.

In the course of his investigations the doctor concluded that when the Bushmen wished to represent two animals standing so closely together as to "overlap," they adopted the slow method of first depicting one animal and leaving it to dry and then painting the other upon it. The reason for this undoubtedly was that the pigmies possessed no sense of perspective. On one or two occasions Dr. Elmore came across shaded drawings.

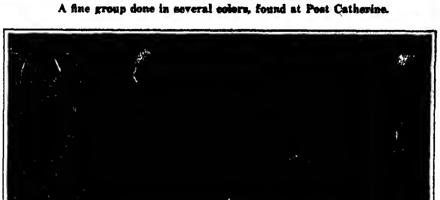
Where the double pictures are seen it would indicate that the little savages were sufficiently long in occupation of the particular caves to have been able to devote some appreciable time to their work; while in those instances in which the panels are

(Concluded on page [illegible].)

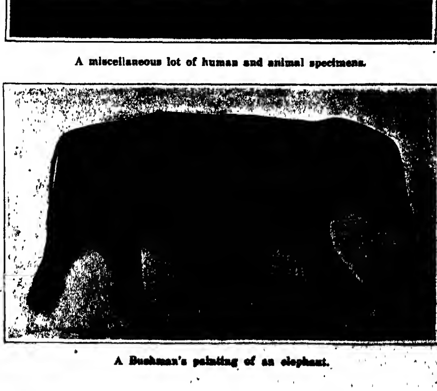
Bushman painting of the chase. From the original of Post Elisabeth.

Hunters rounding up a herd of elephants.

A fine group done in several colors, found at Post Catherine.



A miscellaneous lot of human and animal specimens.



A Bushman's painting of an elephant.

The Heavens in November

The Defining Power of Small Telescopes

By Henry Norris Russell, Ph.D.

GALE'S comet, of whose discovery we spoke last month, is still visible in the evening sky, but only with the telescope. At the beginning of November it is in 16 hours 8 minutes right ascension and 25 degrees north declination, and is moving a little less than 1 degree northerly and 1 minute easterly per diem. Its orbit is nearly, if not quite, parabolic in form, and is remarkable chiefly for the fact that its plane is almost at right angles to that of the ecliptic. Its closest approach to the Sun occurred on October 5th, at a distance of 67,000,000 miles. Though now growing fainter, it will probably be telescopically visible for some time to come.

The second comet to be discovered in 1912 was detected by Schaumasse at Nice on October 18th. It was then in the constellation Sextans in 9 hours 58 minutes R. A. and 1 degree 36 minutes north declination—about 10 degrees south of the bright star Regulus in Leo—and was moving eastward. Until further observations have been obtained, and its orbit computed, it is impossible to say whether it will become conspicuous, or remain faint, as at present; but the chances are in favor of the latter event.

A recent inquiry from a correspondent suggests the discussion of the question of the defining power of small telescopes, such as are in the hands of many amateurs—especially of those from two to five inches in aperture.

Even the smallest of such instruments will reveal enough to afford the star-gazer many evenings of the keenest interest; but there are, of course, limits to the power of any given telescope, both theoretical and practical, and of some of these we may well speak.

The principal functions of a telescope are its light-gathering and magnifying powers. The former depends primarily on the clear diameter—or "aperture"—of the object-glass; the latter, on the relation between the focal lengths of the object-glass and eye-piece.

The pupil of the human eye, when widely expanded, as it becomes in a faint light, is about one fifth of an inch in diameter. A telescope two inches in aperture collects all the light falling on a circle of ten times the radius, or one hundred times the area; and hence, if all the light falling on the object-glass was concentrated, without loss, into the observer's eye, such an instrument should show stars one hundred times as faint as the faintest visible to the eye without its aid. In actual practice, the losses of light by reflection at the surfaces of the lenses, and by absorption in passing through them, diminish the light-gathering power to about two thirds of this ideal value, so that a two-inch telescope will actually show stars about 65 times fainter than those just visible to the naked eye. For a four-inch glass the limit of brightness would be four times fainter; for a six-inch, nine times; and so on, in proportion to the square of the linear aperture.

These facts may be stated in another way, by giving a little table of the stellar magnitude—in the ordinary astronomical reckoning—of the faintest stars visible to a normal eye with a *good* telescope of given aperture, *under favorable conditions*.

Aperture	1 in.	1½ in.	2 in.	2½ in.	3 in.	4 in.	5 in.
Magnitude	9.0	9.9	10.5	11.0	11.4	12.0	12.5

It should, however, be clearly understood that this table shows only what a telescope may be expected to do on a fine clear night, with dark sky (not in moonlight) and with steady air; and that it applies to isolated stars, and by no means to the faint companions of bright ones or the faint satellites of the bright planets.

For example, the third satellite of Jupiter, if isolated, would be easily visible to the naked eye; and two fairly bright stars, at the same apparent distance in the heavens as Jupiter and this satellite (when best placed) could be easily separated without instrumental aid. But Jupiter is so bright that its satellites are actually hopelessly beyond the reach of unaided vision, except perhaps for a few very unusual persons.

With respect to magnifying power, the observer has a little more freedom, for by a simple change of eye-pieces he can pass from one power to another. But here again there are limits. With a power less than five for each inch of aperture (e. g., less than 15 for a three-inch telescope) the light which enters the object-glass is not all concentrated into the observer's eye, and the power of seeing faint stars is decreased. With a power exceeding about 60 for each inch of aperture, the images become hazy, and no advantage is gained by further magnification.

The reason for this is found, not in any imperfections of the instrument, but in the nature of light itself. It can be shown (by methods far from elementary, but mathematically trustworthy) that, if an image of a star is formed by a lens of a given diameter, this image will not be a perfectly sharp dot, but a small disk of light, fading out gradually toward the edge, and surrounded by rings of light, only a few of which are usually bright enough to be seen. In the same fashion, the image of a narrow line of light has the form of a linear band, of small but definite width, with faint attendant bands on each side. These "spurious disks," rings, or bands of light are merely optical phenomena, and have no counterpart in the nature of the object under observation, but they cannot possibly be avoided. When the aperture through which the light passes is narrowed, this "diffraction pattern" grows larger, doubling in size if the aperture is halved. When the opening is very narrow, they may even be seen by the naked eye. For example, if one looks at a linear source of light (such as a flat gas flame seen edgewise) through a narrow gap between two lead-pencils held just in front of the eye parallel to the line of the flame, it is easy to observe that, when the slit through which one is looking is made very narrow, the line of light seems to widen out, and to be accompanied by fainter bands on each side. A still more instructive experiment may be made by looking, through the same improvised slit, at a pair of fine parallel lines close together—such as two wires or strings against the sky. As the slit (which again must be kept parallel to the strings) is narrowed, the dark lines become ill-defined, and they can no longer be seen double.

This latter experiment illustrates perfectly why it is impossible to separate the components of a very close double star with a small telescope. What the eye sees directly in the one case is just what it would observe, with the aid of suitable magnifying power, in looking at a double star through a telescope whose clear aperture could be diminished by an iris diaphragm. When the opening diminishes to a certain size, the star can no longer be seen double.

This theoretical limit of separation of the closest pair of stars that can be resolved by a telescope of given aperture can be found by dividing 4 minutes 5 seconds by the aperture in inches, the results being

Aperture	1 in.	1½ in.	2 in.	2½ in.	3 in.	4 in.	5 in.
Limit of Separation.	4.5 in.	3.0 in.	2.3 in.	1.8 in.	1.5 in.	1.1 in.	0.9 in.

It must once again be emphasized that this applies only to the *most favorable conditions*. The stars of the pair must be of sufficient and nearly equal brightness; the air must be clear and steady, and the observer's eye must be trained; for in such a case the two stars seem so close together that the novice might easily take them for one.

When (as unfortunately is almost always the case) the air is unsteady, the star-images dance about and change shape, and it is only in more or less fleeting moments that they are well enough seen to reveal the two tiny disks of light.

A pair of stars of very unequal brightness must be much farther apart to be observable. As an extreme instance we may take Sirius. This has a companion of magnitude 8.5—which, if isolated, would be conspicuous in a two-inch instrument. When nearest to Sirius (about 1893) it was (according to the computed orbit) fully 2 seconds from it. A pair of stars of equal brightness, at the same distance, could easily have been separated with a three-inch aperture. But, owing to the glare of Sirius, which is ten thousand times as bright as the companion, the latter could not be seen, even with the great Lick refractor, when nearer than 3½ seconds to its primary.

It should finally be remembered that the objects mentioned in treatises on astronomy as "good tests" for a telescope of a given aperture are purposely chosen so that only an instrument of first-class workmanship (and of the given dimensions) will reveal them to a practised eye, under the best observing conditions. Hence the amateur need blame neither his telescope nor himself if he fails to observe them satisfactorily until after acquiring experience on easier objects, and then after many trials.

The Heavens.

As our map shows, the five winter constellations have now returned to the evening sky. Orion is in the southeast, with Sirius blazing below, and Aldebaran and the Pleiades above. Auriga is high in the northeast, the Twins—Castor and Pollux—are below, and Procyon still lower down, due east.

In the duller region of the southern sky we find the extensive constellations Eridanus and Cetus, which are perhaps most noteworthy as containing two of the very nearest stars visible to the naked eye. These are τ Ceti and ϵ Eridani, both of which are shown on our map. That the former was a near neighbor of ours has been known for some years, but recent measures show that the latter has also a parallax exceeding 3 seconds and a distance of about 10 light years. δ Eridani is also near us, though almost twice as far away.

Perseus, Andromeda, and Aries are almost directly overhead. Pegasus, Aquarius, and the Southern Fish are in the west and southwest, and Cygnus and Lyra in the northwest.

Ursa Major is low on the northern horizon, Draco and Ursa Minor but little higher, and Cepheus and Cassiopeia well up in the north.

The Planets.

Mercury is evening star all through November. The best chance of seeing him comes about the 7th, when he is farthest from the Sun in appearance (though almost at the nearest point of his orbit to that luminary). He is, however, very far south, in Scorpio, and sets about 5:45 P. M., so that he will be hard to see.

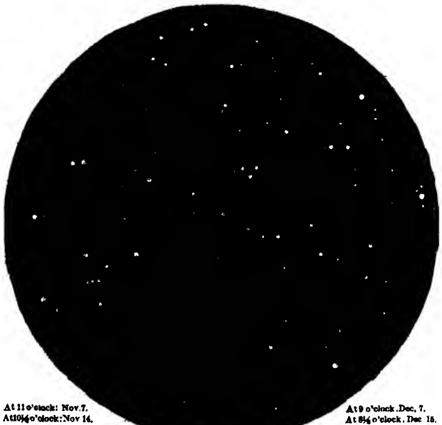
Venus too is evening star, about 15 degrees west of Mercury, and sets about an hour later, but, unlike Mercury, she becomes increasingly conspicuous all through the month. On the 7th she is in conjunction with Jupiter, being 1 degree 43 minutes south of him. The two brilliant planets will be a fine spectacle in the twilight.

Mars is in conjunction with the Sun on the 4th, and is invisible.

Jupiter is evening star, as already described.

Saturn is in Taurus, between Aldebaran and the

(Concluded on page 376.)



At 11 o'clock: Nov. 7.
At 10½ o'clock: Nov 14.
At 10 o'clock: Nov. 22.

At 9 o'clock. Dec. 7.
At 8½ o'clock. Dec 15.
At 8 o'clock: Dec. 23.

At 9½ o'clock: November 30.

NIGHT SKY: NOVEMBER AND DECEMBER

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Modern Methods of Handling Heavy and Bulky Merchandise

IN these days of "scientific management," when the cost of everything has to be carefully considered, it is desirable to use every cubic foot of space in a warehouse and to do the work of stacking and removing cases, etc., with as few men as possible. When land was cheaper, not much thought was given to the area wasted in warehouses; goods often lay around on the floors and the space near the ceilings was neglected. If conditions required the goods to be tiered, many men were required to do the work by the "main strength method." Nowadays, however, any device which will reduce the cost of handling material is as welcome as any improved manufacturing device. Such a modern labor-saving device is a portable tiering machine, an improved type of which is shown by the accompanying illustrations and is known as a revolvator

The revolvator is a portable tiering machine which can be wheeled to any place in a storeroom or warehouse and used for stacking barrels, boxes, bales, etc. It consists of two uprights and an elevating platform. The box or bale is placed on the platform of the revolvator when down, as shown in Fig 1, and by means of a crank and gears the platform is then raised to any level desired. The device is then swung around on its own center, like a turntable, the wheels remaining fixed on the floor, and the load shoved off into place as shown in Fig. 2. Frequently the revolvator is swung around through 180 degrees, and the cases removed from the rear This scheme makes it possible to stack a warehouse entirely solid and to eliminate all aisles.

Rollers are provided on the platform, so that as soon as the box reaches the desired level one man can easily slide it from the revolvator directly into the space where it is to rest. The revolvator is provided with double gears, one for high speed and one for low. Bales, cases, etc., up to 800 pounds can be easily handled by the high gear, and bales weighing from 800 to 1,500 pounds or more by the low gear.

In lowering boxes, bales, etc, the operations are reversed, that is, the platform is raised to a point slightly below the level of the box to be removed. The box is then slid onto the platform and allowed to descend slowly until it reaches the floor The descending load is at all times under the control of the operator, as the machine is provided with a band brake

There is no danger of the machine accidentally slewing around while in operation, as the upright is provided with a ratchet which locks it to the base in different positions Neither is there any danger of the machine moving on its wheels, for when wheeled to position, the front wheel is turned at right angles to the two rear ones, and as soon as the handle is dropped it locks the front wheels, making it impossible for the revolvator to roll

In order that the apparatus may be moved from room to room through low doors or placed on elevators and carried from floor to floor, the uprights are jointed, allowing the top half to fold over

The revolvator is used for handling cases, bales, barrels, rolls and reams of paper, crated machinery, bath tubs, etc., in warehouses, and is also employed for loading railroad cars, trucks, etc.

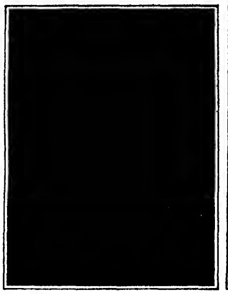


Fig. 1.—The box placed on the revolvator when the platform is down, is raised by a crank and gears.

Fig. 2.—The box when elevated to the desired level is easily rolled off into its proper place.

Dumping Fifty-four Tons of Coal in Two Minutes

THE economical handling of coal on its way from the mines to the consumer is a problem affecting the retail price of coal. The more efficiently the coal can be handled in the various transhipments, the better. Water transportation is the cheapest, and coal unloading machinery has been devised at various American coal ports for rapidly and cheaply transporting the coal coming from the mines (in 80 and 100 car trains) into the holds of waiting vessels. The annexed illustrations show a car dumper in use at Norfolk, Va., in action. This car dumper is an integral part of an elaborate coal unloading plant constituting the tidewater terminal of one of the coal-carrying railroads from the West Virginia mines. Its operation is the most interesting feature of this plant, as it empties railroad coal cars holding 50 to 54 tons of coal each as easily as the driver of a coal cart tips his load on to the sidewalk. The car dumper consists of a steel structure supporting a movable, elevated cradle. The loaded railroad cars are pulled up an incline one at a time by an electric motor-driven cable hoist. The moment the car reaches the cradle the car dumper operator starts a motor which first clamps the car securely down on to the cradle and then tips the cradle up and over through an angle of 100 degrees, so as to pour out the contents of the car onto a deflecting apron and into a receiving car waiting on a track level below The receiving car (which is electrically operated) then conveys the load of coal up on to the pier from which it is discharged into the vessels.

The illustrations show the car dumper in two stages of its movement, and the hazy appearance above the apron in the second view is caused by the cloud of dust that arose from the 54-ton mass of coal poured out of the railroad car an instant before the photograph was taken.

The car beginning to turn.

The car in dumping position.

Miniature Baseball Game

A NEW amusement device has just been brought out which is played on a miniature diamond on a table similar to an ordinary billiard table. Miniature figures of players are used and they are disposed in the positions ordinarily occupied by baseball players on a regular diamond. The players are placed over a series of pockets. The face and sides of these pockets are cushioned and are so designed that the ball enters quickly and quietly. On either side of the table and in the rear there are pockets indicating singles, triples, home runs and fouls. The batter's box is near the front of the table, where an average size billiard ball is placed and then caromed off on a triangular rubber homeplate which is mounted on a pivot. This plate revolves when hit by the ball, giving the player a constantly changing shot which makes the game very scientific.

A Submarine Lifesaver

THE shock and horror of the loss of the "Vendemiaire" is of course still keenly felt in France, and it is much to be hoped that the new life-saving device for submarine crews will turn out to be all its inventor claims. M. Laplanche, of Toulon, who has just patented the apparatus, is an old sailor. His invention, as described in the marine journal, *Navigazette*, consists of a waistcoat and a helmet. The former, which permits entire freedom of movement to the wearer, is double and can be inflated with air or gas under pressure. It should be donned in every descent, and is intended to insure the rising of the wearer to the surface of the water.

The helmet is assumed only in case of danger and is meant to make respiration possible. It is capable of very rapid adjustment to the waistcoat.

The inventor is about to make three tests. The first, which will take place in a pool, is to show how long a man thus fur-

[...]ished can live in the water. The second, to take place in a port, will be conducted as nearly as possible under the same conditions as in a real submarine which has met with accident. It is expected to prove that the wearer of the apparatus will come to the surface with certainty. The third will also take place in a port, making use of a salvage chamber, constructed by Laplanche to complete his invention.

Compulsory Licenses

By T. Hart Anderson

UNDER the provisions of the Oldfield bill, it is proposed to amend the patent laws so as to provide for the granting of compulsory licenses in those cases where a patent is more than four years old, and the patentee or those claiming under him fail to manufacture in the United States to an adequate extent, and provided the court is satisfied that the reasonable requirements of the public have not been satisfied by reason of the neglect or the refusal of the patentee to make, use or vend the invention, or to grant licenses to others on reasonable terms, it shall order the owner of the patent to grant a license to one applying therefor on terms to be fixed by the court.

This brings up the question as to whether courts of equity have not heretofore had and do not now have the right to compel the granting of such licenses, and whether they have not in fact assumed such right whenever the character of the evidence has warranted it.

Injunctive relief alone prevents the continued infringement of a patent, that is to say, the manufacture, use or sale of the patented invention by a stranger to the patent and without the consent of the owner of the patent. We all know that the refusal of a license does not prevent the appropriation of a patented invention by one who desires to use it. One who so appropriates a patented invention, however, places himself in the position of an infringer and is liable to the patentee for damages.

If the owner of a patent sues for damages alone, and a verdict is rendered in his favor, the infringer pays the amount awarded, and if he still desires to use the invention he may go on as before, leaving the patentee to his right of again suing him at any time within the running of the statute of limitations. The damages recovered constitute in effect a license fee which the infringer pays, and we may assume he is willing to pay for the license which he has appropriated. This is practically a compulsory license while it lasts, and sometimes, owing to the crowded condition of our courts, it may last for a period of years.

The owner of a patent, however, as a rule not only desires to secure damages, but also an injunction preventing and restraining the infringing acts in the future, and therefore patent suits are generally brought on the equity side of the court, and if the court finds the patent to be good and valid and that the defendant has infringed, it will issue an injunction restraining in the future the infringing acts of which the owner of the patent complains. As before stated, it is this injunctive relief which, when granted by a court of equity, puts a stop to the compulsory license arising from the unauthorized appropriation by an infringer of a patented invention.

The right to grant injunctions in patent suits is conferred upon the Federal Courts by statute, section 4,921 R. S. providing that such injunctions may be issued "according to the course and principles of courts of equity, to prevent the violation of any right secured by patent, on such terms as the court may deem reasonable."

The first legislation referring to injunctive relief in patent cases is the Act of 1819, which provided that the circuit courts of the United States "shall have authority to grant injunctions, according to the course and principles of courts of equity, to prevent the violation of the rights of any authors or inventors secured to them by any laws of the United States, on such terms and conditions as said courts may deem fit and reasonable." This provision of the Act of 1819 was substantially embodied in the Act of 1836, wherein section 17 provided for the granting of injunctions "on such terms and conditions as said courts may deem reasonable." The Act of 1870, section 55, contains practically the same provision "and the court shall have power upon bill in equity filed by any party aggrieved, to grant injunctions according to the course and principles of courts in equity, to prevent the violation of any right secured by a patent, on such terms as the court may deem reasonable." Then came the Revised Statutes, section 4,921 hereinbefore referred to, which is now the law, and which was amended by the Act of 1897 to fix a period beyond which damages could not be recovered.

It is therefore to be seen that courts of equity may fix *reasonable* terms upon which they will grant an injunction. It follows therefore that they may also refuse an injunction on reasonable terms. Whenever an injunction is refused, therefore, in those cases where the patent is good and valid, and infringement is proven, a *compulsory license* results, and in effect the court issues an order for a compulsory license in such form and upon such terms as it deems just. Strictly speaking, the court does not issue a license, but in refusing to disturb the infringer and to restrain his infringing acts, it to all intents and purposes grants a compulsory license.

Acting under the power thus conferred, courts of equity have time and again refused injunctions where the patent was valid and infringed.

In the case of Bullard v. the City of Pittsburgh, 12 F. R., p. 783, it was found that the city had infringed the patents sued upon, in that it had laid a wooden pavement constructed in accordance with the patents, but the court declined to issue an injunction on the ground that "any interference with the use of the wooden pavements constructed in the city of Pittsburgh, in infringement of the complainants' rights, would only operate injuriously upon the public without benefiting the complainants, and injunction will not be granted." The court however decreed an accounting to ascertain the profits and damages which should be awarded the complainants, which was in effect the amount of the license fee to be paid for this compulsory license so awarded by the court. The court in this case undoubtedly found that the "reasonable requirements of the public" justified it in *refusing* an injunction on reasonable terms.

It is true that the courts hesitate to refuse injunctions where the right to relief is clear, but the foregoing case shows that under some conditions they will do so.

In the case of Campbell Printing Press and Manufacturing Company v. Manhattan Railway Company, 49 F. R., 931, the court while refusing to act on the defendant's suggestion that because it was willing to pay for the use of the infringing devices it should be permitted to continue to use them on the ground that it would seriously interfere with the running of its cars if it were compelled to take off the infringing devices, yet the injunction was granted on terms which no doubt the court deemed reasonable, and the defendant was given a certain length of time to remove the alleged infringing devices. During the running of that time, the defendant had in effect a compulsory license.

Many times have the courts refused to grant preliminary injunctions on the ground that the injury to the defendant would be greater than the advantages to the complainant, as in Hoe v. Advertiser Company, 14 F. R., 914, and thus on terms which seemed reasonable to the court, it in effect granted a compulsory license, at least for the time the suit was pending.

Suppose a case where the public health, public safety or the welfare of the nation were involved, what would a court of equity do should a patent owner seek an injunction restraining the manufacture, sale and use of devices which the evidence showed were essential to prevent epidemics, to save life, to repel invasion, and that there were no substitutes immediately available, would it grant an injunction, or would it refuse the injunction because of the "reasonable requirements of the public" and decree compensation in damages and profits, thus in effect granting a compulsory license? We believe that in such a case a court of equity would not hesitate to refuse an injunction, on the ground that an injunction would operate injuriously upon the public without benefiting the complainant. It would however decree an accounting so as to ascertain the amount of damages and profits which would be payable to the owner of the patent for this compulsory license. Such a proceeding would not differ materially from that provided by Section 17 of the Oldfield bill to compel the granting of a compulsory license. It would therefore seem that in many cases where the "reasonable requirements of the public" seem to require it, compulsory licenses are awarded by the courts.

Legal Notes

Patentability of Article as Affected by Process of Making.—In affirming the decision of the Commissioner of Patents, *In re Hodkinson* application for patent for an iron or steel conduit pipe, the Court of Appeals of the District of Columbia has held that in considering the question of the patentability of an article made by whatever process one may choose to employ, the superiority of the process by which it is actually made is immaterial.

Some Adjudicated Patents.—In the suit of the Carlson Motor and Truck Company v. Maxwell-Briscoe Motor Company, 197 Fed. Rep., 309, claim 1 of the Carlson patent, No. 797,555, for internal combustion engines was held valid and infringed. In recently decided cases, the Coffield reissue patent, No. 12,719 (original number 806,779) was held valid and infringed; the Mell patent, No. 898,907, for vehicle wheel tire, was held void for lack of invention in view of the prior art; the Washburne patent, No. 517,084, for a cuff fastener, was held void for anticipation, also not infringed if conceded validity; the Washburne patent, No. 553,972, for a clasp or fastener, was held not infringed; the Moody patent, No. 591,869, for an electric transformer, was held not infringed, and the Coldwell and Gildard reissue patent, No 11,923 (original number 637,234), for a stop motion for looms, was held valid and infringed.

Substitution of Material.—The question of patentability involved in the substitution of material raises interesting questions. The case of *ex parte* Hobbs decided by Commissioner Moore, in which he affirms the decision of the Board of Examiners in Chief, involved the substitution of sheet metal for wood in billiard counters and the Commissioner held that it did require invention, the advantages alleged for the metal counters being due to the well-known properties of sheet metal. In discussing the case, the Commissioner said it was believed to fall in the class of devices held to be unpatentable by the substitution of material, citing certain cases, because the substitution developed no new uses or properties, rather than in the class where the substitution was held to involve invention and to be patentable. He referred to the distinction between the two classes being well set forth in Union Hardware Company v. Selchow, in which the Court said, quoting another case: "Both involve a change of material in existing structures but in the one instance the skate operates after the change precisely as it did before, and in the other a hose supporter which does not support is converted by the change into a hose supporter which does support. In the former case by the use of cheaper, lighter and stronger metal the skate is made cheaper, lighter and stronger, in the other the substitution of a rubber button for a metal button transformed a destructive and inoperative device into a highly successful one."

Notes for Inventors

Adds Rubber to Resene in Chewing Gum.—In a patent, No. 1,040,285, James D. Darling, of Philadelphia, describes a process of manufacturing chewing gum in which he adds to reseno a suitable proportion of rubber to render it plastic at the temperature of the mouth.

Clothes Washing Pounder.—In patent No. 1,039,701 to Edwin R. Crooker, of Los Angeles, Cal., there is shown a clothes pounder with a conical body having a handle socket at its apex with a soap receptacle within the conical body at the apex and immediately below the socket for the handle.

High-grade Flour from Low-grade Grain.—For producing a high grade of flour from a grain low in proteids Johann Georg Ferdinand Dombach, of Amsterdam, Netherlands, has patented, No. 1,040,290, a process for treating the grain which consists in mixing with a quantity of the grain low in proteids about one half as much more of light grain incipiently germinated, but whose germination is stopped before reaching the stage to produce malt.

A Demand for Coal-weighing and Discharging Machine.—One of the Consular and Trade Reports of the Department of Commerce and Labor calls attention to the fact that an American consul has inquiries from a firm in his district for automatic apparatus for discharging coal from vessels, indicating that the apparatus should be capable of weighing the coal as it is removed and suggesting that a suction type of equipment which will remove the coal from below decks into the square of the hatch lifted up on deck, weigh it and deliver it into lighters, is desired.

A Piano Violin Patent.—Walter E. Fox of Chicago has secured patent No. 1,036,600 for a musical instrument in the form of a piano violin having a keyboard and means for simulating the playing of a violin which include in connection with framing, a vibratory string and an endless band traveling across the string and between pairs of rollers and twisted thereby to present a broad surface to the string and also means actuated from the keyboard for rocking the shaft carrying the rollers in order to move the band into engagement with the string.

A Syrup with Maple Sugar Flavoring.—At this time when, so much is being said about the high cost of living, it may be interesting to note that a West Virginia man has patented what he terms a saccharine article of commerce which is composed of sugar and an extract obtained from the outside lifeless bark of the rock or sugar maple so that the syrup will have a maple flavor. In the process of making this article, the outside lifeless bark taken from the trunk of the rock or sugar maple tree is boiled in water until an extract of the desired strength is obtained and the liquid is then strained and commercial sugar added and boiled until the strength is satisfactory.

An Unsinkable Rubber Boat.—At the recent Rubber Exposition in New York, Mr Joseph Pastorel of Asbury Park, N. J., exhibited an ingenious rubber boat. The frame is covered with sheet rubber or rubber cloth in such a way as to form independent air-tight compartments which can be inflated to increase the buoyancy of the boat. The elasticity of the materials employed, in the opinion of the inventor, will enable the structure to withstand severe blows and shocks. When subjected to rough usage, the boat, he states, will yield instead of breaking, as it undoubtedly would if wood or iron were employed in its construction. Masts, inflatable square sails, and wings are included in the equipment of the boat. The sails and wings are made of rubber and can be inflated by compartments, the idea being that they will add to the buoyancy of the boat. When lowered all the way down, the sails rest on the deck and the wings right at the edge of the boat. The masts are made of hard rubber.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

HAT BOX.—U. ULLITZ, 228 Audubon Ave., New York, N. Y. This box is constructed of telescopic sections with means for holding the sections at predetermined positions relatively to each other to accommodate hats of different sizes so that the hat box may be packed in a trunk without danger of injuring the hat. The head of the outer end of one of the sections is removable to permit the user to reach the interior of the hat box.

Pertaining to Aviation.

GYROPLANE.—N. E. BROWN, Grand Haven, Mich. This invention contemplates a revoluble aeroplane adapted to ascend or descend vertically, either in a horizontal or inclined path. The invention is preferably termed a "gyroplane," this name being appropriated by reason of the analogy which the machine bears in action to the gyroscope.

Electrical Devices.

HIGH POTENTIAL INSULATOR.—LOUIS STEINBERGER, Brooklyn, N. Y. Mr. Steinberger's invention relates to high potential insulators, and more particularly to such insulators of special form as are adapted to be mounted upon a wall, a floor, a roof or a partition or adapted for use in connection with oil switches and oil transformers, and in various analogous relations.

TROLLEY WIRE SWITCH OR FROG.—J. KIRBY, P. O. Box 415, Douglas, Ariz. An object here is to make an easy and more reliable connection between the main line wire and a switch wire than has hitherto been possible. Also to provide means for reducing the danger of a misplaced trolley from becoming lodged in a switch or frog.

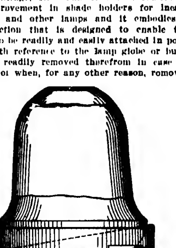
CONNECTING TERMINAL.—A. J. ALLEN, Room 1821 Tribune Bldg., New York, N. Y. This invention provides a contact member to be secured upon the end of a flexible conducting cord or the like, said member having a portion serving the double purpose of a wing screw for holding said member upon said cord and fitting upon a binding post for the purpose of establishing electrical communication from said cord to the same.

Of Interest to Farmers.

DOUBLE KNIFE BOX FOR BEET ROOT SLICING MACHINES.—M. PASCHEN, care of Alexander Katz, Köthen, Germany. In the present invention the clamping plate of the front knife which serves as counter piece for the rear knife is tippable about an axis in proximity to its front edge in a manner known in connection with single knife boxes and front knife counter-pieces of double knife boxes and is provided with height adjusting means for its rear upper edge which adjusts the rear edge of the bearing plate in height independently relatively to the cutting edge of the rear knife without the whole of the front knife being simultaneously moved forward parallel therewith.

Household Utilities.

SHADE HOLDER.—H. GOODFRIEND, care of Chicago Gas & Elec. Fixture Co., 4445 Clinton Ave., Chicago, Ill. This invention relates to an improvement in shade holders for incandescent and other lamps and it embodies a construction that is designed to enable the shade to be readily and easily attached in position with reference to the lamp globe or bulb, and as readily removed therefrom in case of danger or when, for any other reason, removal



SHADE HOLDER FOR INCANDESCENT AND OTHER LAMPS.

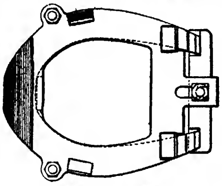
is necessary. Its use is not restricted to a shade holder, but may be employed in other relations. The holder may be attached to the lighting fixture on which it is used either in upright position or in horizontal or inverted position. The engraving pictures a side elevation of the shade holder, partly in section, showing the construction of the holder.

Of General Interest.

ADJUSTABLE SPRING BEARER.—F. A. RABBE, 892 Jefferson Ave., Brooklyn, N. Y. This invention has reference to a new and improved spring-bearing roll for use in printing presses, to draw off the paper without breaking, and to allow for several thicknesses of paper on the roll.

BANANA PACK SADDLE.—A. B. ROBBINS, P. O. Box 586, New Orleans, La. This saddle is designed for use in carrying bunches of bananas from plantation to receiving or loading stations. The saddle comprises a top pocket, side pockets below the latter at opposite sides of it and intermediate pads forming partitions between side and top pockets. Means provide for protecting the fruit from bruises from projections in the road and injury from the sun.

OVERSHOE FOR HORSES.—C. G. DELANO, R. F. D., Taunton, Mass. The object of this overshoe is to prevent the slipping incident to certain conditions of slime covered roadways and to sleet and ice-covered pavements, the said calks are sharpened, and preferably formed from suitable hard wearing material



OVERSHOE FOR HORSES.

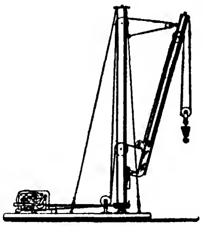
such as chilled or air-cooled steel. In the usual practice to which the employment of the shoe lends itself, the overshoe is carried for use in any emergency. The engraving presents a bottom plan view of the overshoe, showing the same in conjunction with the ordinary wearing shoe to which the overshoe is secured.

Prime Movers and Their Accessories.

EXHAUST MOTOR.—C. F. HIGH, 1488 Williamson St., Madison, Wis. The principal object of this invention is to provide a motor construction whereby the power of an engine may be increased and the operation thereof rendered more efficient by taking care of the exhaust from this engine and utilizing the power present within.

Pertaining to Recreation.

MECHANISM FOR OPERATING TOY DERRICKS.—A. PFEIFFER, 550 W. 144th St., Manhattan, N. Y., N. Y. In this case the aim of the inventor is to provide a new and improved mechanism for operating toy derricks arranged to raise, lower or swing small loads by the use of a motor driven mechanism easily controlled by children, affording considerable amusement and at the same time providing



MECHANISM FOR OPERATING A TOY DERRICK

an instructive toy. A boy or other child can readily control the motor by manipulating the reversing lever thereof, and also readily control the two handles for operating the derrick with a view to raise or lower the load, to swing the boom up or down or sidewise on turning the post. A side elevation of the invention is shown in the illustration.

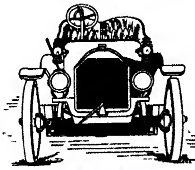
Pertaining to Vehicles.

ATTACHMENT FOR BABY CARRIAGES.—J. T. MURPHY, 850 Oakland St., Brooklyn,

ATTACHMENT FOR BABY CARRIAGES.

N. Y. This attachment supports a canopy or mosquito netting, and is adapted to be fitted to any carriage within the limits of adjustment of the attachment. Provided is made for adjusting the device as to length and width, in accordance with the size of the carriage body with which it is to be used. The invention comprises a bottom frame having side bars and a cross bar, and upwardly extending end members that curve inwardly toward each other and overhanging at the top, the one end member overhanging to a greater degree than the other. The engraving shows a side elevation with the netting in place, a carriage being indicated in dotted lines. The invention can be used on a bed couch or the like.

SUSPENSION DEVICE FOR AUTOMOBILES.—J. P. WILL, 261 Union St., Jersey City, N. J. To deaden the jolting and jarring encountered in passing over rough roads, the suspension frame is so designed that the body of the vehicle is supported on axles with its center of gravity in the lowest position; and it includes an arrangement of vertically and horizontally yieldable springs, by means of which the vibrations of the vehicle in motion

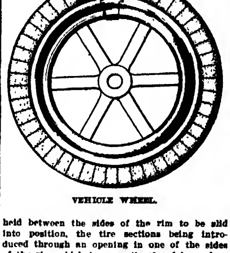


SUSPENSION DEVICE FOR AUTOMOBILES.

are reduced to a minimum, thus permitting occupants to travel with the greatest degree of comfort even when rubber tires are not used. The illustration herewith shows a front view of an automobile showing the suspension frame in place between the vehicle body and the front axle thereof.

VEHICLE JACK.—H. F. LIDDON, care of W. T. Adams, Corinth, Miss. This automatic jack is for axles of automobiles and other wheeled vehicles, the same having a rocker body to which is pivoted an axle-supporting bar adapted to automatically engage an axle when a vehicle is run over the jack. It is particularly adapted for use in supporting automobiles so that their tires may be entirely relieved of pressure when in the garage.

VEHICLE WHEEL.—PAUL D. MURO, Habana, Cuba. The present invention has reference to vehicle wheels and it has for its object the provision of one with a rim having converging sides so that the tire sections having lateral extensions at their inner ends may be



VEHICLE WHEEL.

held between the sides of the rim to be slid into position, the tire sections being introduced through an opening in one of the sides of the rim which is normally closed by a door hinged to the rim. A side elevation of the invention is represented in the engraving.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We are prepared to render opinions as to validity or infringement of patents, or with regard to conflicts arising in trade-mark and unfair competition matters.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & CO.,
Patent Attorneys,
361 Broadway,
New York, N. Y.

Branch Office:
625 F Street, N. W.,
Washington, D. C.

Launching of the Battleship "New York"

(Concluded from page 362.)

Dakota," and so on. As we have said, the principal difference between the "New York" and the "Wyoming" is found in the armament. The new 14-inch gun is an extremely powerful weapon and a great advance upon the 50-caliber 12-inch gun of the earlier ship. The increase in dimensions and power over the 12-inch type is as follows: Length, 54 feet, as against 51 feet; weight, 63.3 tons, as against 56.1 tons. The velocity is less by 300 feet, being 2,600 feet per second at the muzzle, as against 2,900 feet, but the shell has gone up in weight from 870 to 1,400 pounds, and the muzzle energy has risen from 51,644 to 65,687 foot-tons. The extreme range has fallen from 24,000 yards to 21,000, a matter of no significance, as this range will never be used in practice. The penetration at 10,000 yards is about the same, being 15.6 inches through Krupp armor for the 12-inch guns and 15.9 for the 14-inch guns. The greater power and effectiveness of the 14-inch piece is due chiefly to the very large bursting charge of high explosive contained in the shell, and the larger number and greater total weight of the flying fragments. Three or four effective hits, with penetration, out of a salvo of eight or ten 14-inch guns would go far to settle the fight, either by immediate disablement or such damage to the ship and demoralization of the crew as would prevent the enemy from doing effective work during the rest of the engagement.

An interesting fact concerning the "New York" and the "Texas," is that they are both propelled by vertical, triple-expansion engines. This type of motive power was decided upon at the time when the efficiency of the steam turbine had not reached the point which it holds to-day; for the introduction of reduction gear seems in a fair way to solve the difficulties of the turbine marine drive. It is likely that the "New York" and "Texas" will be the last ships of our Navy to be driven by reciprocating engines.

The "New York" is protected by 12-inch Krupp armor on waterline and gun positions. The secondary battery consists of twenty-one 5-inch rapid-fire guns.

Aerodynamic Experiments of Duc de Guiche

(Concluded from page 368)

the front plate of the car, and when running it was seen that the streamer kept quite parallel to the car's direction, showing that there were no rising or descending currents at that level.

The inventor used a method by which he was able to take a very accurate record of the air pressures upon different points of the surface of the plate. The pressure at any given point was obtained by using a small open tube which ran through a hole in the plate and lay flush with the surface. The tube was connected by a rubber tube to a pressure gage placed on the automobile. After trying various kinds of gages, he settled upon a simple U-tube partly filled with liquid and having the rubber tube attached to one branch, while a scale placed in the rear served to show the pressure by the rise of the water column. By narrowing up the tube in the bent portion it was possible to use distilled water for the gage without any marked vibrations due to the running of the car, thus avoiding the use of glycerine or other heavy liquids.

One of the most ingenious devices is the one which was used to take photographs of the pressure gage records. What is desired is to find the pressures along one line of the test plate at the same time, and by using eight separate holes and tubes along one line he could obtain eight records in a single run of the automobile and was sure that the working conditions were always the same. An instantaneous photograph of all the eight gages in line was taken at the moment when the automobile passed the line, and a permanent record was thus fur-

nished. One of our views shows the eight tubes leading from the test plate to the box containing the pressure gages. In the box is an illuminated scale and a camera for taking the record, and the operator works the shutter while the automobile is between the rubber tubes on the road. Added to the series of gages is an extra gage with both ends free and having the water columns both at the same level, in order to serve as a check and to enable one to make any slight corrections for the movements of the liquid when on the road.

By taking the pressures along various lines of the test plate, a chart is obtained which shows the pressure all over the plate. The method employed by the Duc de Guiche appears to be one of the most accurate yet employed for such experiments.

The Bushmen of Africa

(Concluded from page 870.)

not so finished the obvious inference is that the artists had not the same leisure in which to do them—probably being harassed by enemies or having to make long journeys to replenish their food supplies. Under the more adverse circumstances their unique mural decorations were not so perfect in detail. The markings on the animals, if not reproduced in their actual colors, have nevertheless been defined with striking clearness by the rude painters with the meager means at their command. Mr. Thomas Baines, F. R. G. S., the celebrated South African traveler, has held that the coloring was done with a feather; but in Dr. Elmore's opinion the extreme fineness of many of the lines effectually combats this contention, and that a people able to execute such paintings would make brushes by binding together bristles plucked from dead animals.

Etching on parts of the rock is also shown to have been freely indulged in by the Bushmen, and with a truly astonishing degree of skill. Such work is found on the flat, smooth rocks in different parts of the colony and exposed to the weather; but seldom are paintings and etchings to be seen together.

At Vryburg, just before entering Mafeking, are some fifty or sixty etchings, each Dr. Elmore states, magnificently done. One of them, a giraffe, over two feet in height, is a really beautiful specimen, and near it are outlines of hippo and eland.

A somewhat striking difference between the etchings and the paintings (although both are always found in profile) is that in the former the eye of the animal is distinct, whereas it is almost invariably non-existent in the latter.

Having obtained a thorough insight into the subject of the Bushmen paintings so far as South Africa is concerned, Dr. Elmore has left for Australia, for he has learnt that the aborigines there also decorated their dwellings with quaint colored drawings. From the Commonwealth, after careful investigation, he proceeds to the United States, and then directly for Arizona, to study the primitive etchings in that district. His object is to ascertain whether any connection between the three may reasonably be deduced.

The Heavens in November

(Concluded from page 871.)

Pleiades, and is well placed for observation, being in opposition on the 23d. His rings are now seen widely opened, and he is a splendid telescopic object.

His largest satellite, Titan, appears of magnitude 9.4, and is therefore visible in any telescope exceeding two inches in aperture. The next brightest satellite, Rhea, is of magnitude 10.8, and, if isolated, might be seen with an aperture of 2½ inches; but, being near the planet, an aperture of 3 inches will probably barely show it. The next two satellites (counting inward toward the planet) Dione and Tethys, are of magnitudes 11.5 and 11.4, and require fully 4 inches aperture to show them. Titan, whose period is very nearly 16 days, may be found on the west of Saturn on November 3d, south on November 7th, east on the 11th, etc. Rhea,

whose period is 4 days 12 hours, is east of the planet at 3 A. M. on the 3d, 3 P. M. on the 7th, etc. The observer with an astronomical telescope will, of course, remember that it "inverts" the object under observation, so that the satellite will appear east of the planet when really west of it.

Uranus is evening star in Capricornus, now pretty low in the west. Neptune is in Gemini, and comes to the meridian about 4 A. M.

The Moon is in the last quarter at 9 P. M. on the 1st, new at 7 P. M. on the 8th, in her first quarter at 4 P. M. on the 16th, and full at 9 A. M. on the 24th. She is nearest us on the 3d, farthest away on the 16th, and nearest again on the 28th. She is in conjunction with Mars on the 8th, Mercury on the 10th, Jupiter and Venus on the 11th, Uranus on the 14th, Saturn on the 24th, and Neptune on the 28th.

Princeton University Observatory.

Panama Exposition Postage Stamps

THE Postmaster-General recently in approving the designs prepared by the Bureau of Engraving and Printing for the special issue of postage stamps to commemorate the opening of the Panama Canal, directed the 80,000,000 one cent, 150,000,000 two cent, 8,000,000 five cent and 5,000,000 ten cent stamps be prepared, and that they be placed on sale beginning January 1st, 1913.

The series comprises four denominations, as set forth above. The stamps are about three fourths of an inch high by one and a sixteenth inches wide; at the top appear the words "U. S. Postage" and "San Francisco, 1915," in the left hand border is a branch of laurel and in the right hand border a palm branch; a numeral expressing the denomination is shown within a circle in each lower corner, with the word "cents" between. The one-cent stamp is green and in the center appears within a circle, a bust of Balboa, discoverer of the Pacific Ocean, looking to the left, and wearing a cuirass and a helmet with a plume. On either side of the background are palm trees with the ocean in the foreground. Below the portrait, in a horizontal panel breaking the circle, are the words "Balboa, 1513."

The two-cent stamp is red. It represents the Gatun locks of the Panama Canal, with a merchant steamer emerging from one lock and a warship in the other. The mountains of the Isthmus appear in the distance, and palm trees on the right hand side of the locks. Beneath the picture are the words "Gatun Locks."

The five-cent stamp is blue, and presents the Golden Gate of San Francisco harbor, with the setting sun in the background and a steamer and a sailing vessel in the bay. The words "Golden Gate" appear below the picture. The ten-cent stamp is dark yellow. The subject is "Discovery of San Francisco Bay," from a painting which represents the discovering party looking out upon the distant bay. All of the new designs are fine examples of the engravers' art.

Notice

IN view of many inquiries received from subscribers and advertisers relative to a new edition of the Encyclopedia Americana and certain other publications issued or sold by the Americana Company or "Scientific American Compiling Department," Messrs. Munn & Co., Incorporated, state that such publications have no connection whatever with the SCIENTIFIC AMERICAN published by them, and that Messrs. Munn & Co., Incorporated, have no interest of any sort in the business of the Americana Company or of the so-called "Scientific American Compiling Department." The use of the words "Scientific American" in connection with the latter is without the approval or consent of Messrs. Munn & Co., Incorporated, and notice has been served upon the Americana Company that the use of the above title must be discontinued.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12691) F. S. asks: In general, and under normal conditions, if not growing too closely together, the trunks of nearly all trees of all species grow straight upward, that is, perpendicular, whether they grow on the level or on any steep incline. What natural law operates here to bring about this effect? A. A tree grows toward the light and warmth of the sun. In general this causes a growth vertically upward when the trees are thickly set over the ground, or when one tree stands out alone. In a small clump of trees the trunks usually lean outward and away from each other. The slope of the land does not affect the direction of the growth of trees to any appreciable extent. Trees show the effect of warmth by extending their branches farther out on the south side, and by forming the annual rings thicker on the south than on the colder north side. One can usually tell very easily how a tree stood as to the points of the compass by an inspection of the trunk.

(12692) H. E. C. writes: Upon a sheet of paper place a heap of bronze powder, such as is used in printing. Two wires forming the terminals of a 220-volt direct-current electric circuit, and having a voltmeter in series, are used. Let the ends of the wires be inserted in the heap of powder. If the wires are rather far apart, no current is readable on the voltmeter. The two wires are then approached to each other, and gradually the needle of the voltmeter indicates the passage of a current. The wires may then be drawn a distance apart and the current persists. Now comes the astonishing feature. If the wires are rather close to each other, and a current passing, then upon slowly lifting the wires out from the powder the needle of the voltmeter does *not* come back to zero. We have succeeded in raising the wires as much as one inch from the powder and one inch from each other without the breaking of the current. At first sight it looks as though there is a silent passage of current through an inch of air. Upon closer inspection, however, it will be seen that there extends either from one wire to the other, or from both wires to the heap of powder, a spider web thread of bronze powder. The current passes through this thread. Upon the first discovery of the thread we thought that some liquid was mixed with the powder, but this was soon proven to be incorrect. The disconnection of the electromotive force nullified all efforts to draw out the powder into threads. The same phenomenon was observed with bronze powder which had been cleaned with benzol. The same was observed with graphite, except that with graphite a number of threads could be drawn out simultaneously, and sparking was observed on one or two of them. An attempt to do the same with cast-iron powder was unsuccessful, possibly because the powder was too coarse. A thread extending from one wire to the other could easily be drawn by first placing on the wire a little heap of powder, touching the two wires together, and then gradually drawing them apart in the air. By this means threads an inch long were made. Upon pulling the wires apart too far the thread broke but did not fall; it remained hanging. Upon now approaching the wires together, the hanging thread would curl up against the force of gravity and would always be attracted and attempt to reach and join the other wire, proving immediately that the phenomenon was electric. An explanation of the above can no doubt be easily given by means of lines of force, etc., but we shall leave said explanation to others. A. Our attention has never been called to this interesting experiment before. It may be entirely new. The explanation seems clear. It is probably a case of cohesion of the same sort as occurs in the Branly coherer, which was at first used in wireless telegraphy. The cause of the cohesion of the particles of metal is believed by many to be a welding due to heat. The sparking when graphite was used showed that the heat was considerable. The voltmeter in series becomes an indicator of current simply, a rheostat to all intents as well. Its resistance is not given. If it has the usual resistance of such an instrument, say 19,000 to 20,000 ohms, more than a hundredth of an ampere flowed at 220 volts when the wires touched each other. This is ten times the current necessary to work a coherer, and a strong result would be expected. We have repeated the experiment, carrying the resistance up to over 50,000 ohms, and at 110 volts there was then current enough to burn the graphite and weld the bronze particles. The sparks were produced when the ends of the wires were a good distance apart—¼ inch certainly. We did not succeed in producing the chain of particles hanging from one wire and attracted to the other wire. This seems to be the same action as of the gold leaves of an electroscope, an attraction of unlike charges. The two wires are at different potentials, one charged positively and the other negatively. The tiny chain free to swing is drawn to the opposite charge on the other wire. A gold leaf electroscope can be charged with 110 volts, using a second plate as a condenser. This is an old experiment to show that the electricity of the dynamo and of the static machine [illegible] same electricity, differing only in degree of [illegible]. We feel very [illegible] that we have [illegible] in the above [illegible].

NEW BOOKS, ETC.

THOMAS'S REGISTER OF AMERICAN MANUFACTURERS AND FIRST HANDS. New York: Thomas Publishing Company, 1912. 4to.; 3,600 pp. Price, $15.

This enormous volume is the equivalent of a complete library of directories, covering every existing trade, all bound in one volume, with an index naming more than 60,000 articles. It includes over 300,000 names, together with the ratings. This book came into immediate use when it reached the reviewer's table, and we have found it most helpful. No other comprehensive book of a similar nature gives the capital of each company. This will prevent disappointment in mailing large quantities of circulars. One of the most valuable features is the trade name or special brand section, printed on tinted paper, which lists over 30,000 marks in actual use. The work is also printed on a special imported paper, otherwise its enormous bulk would be even more increased. It is an indispensable book for every office, and should have a large annual sale.

TRADE MARKS AND TRADE NAMES. For the Business Man. New York: Munn & Co., 1912. 16mo.; 48 pp.

The purpose of this little book is to present in the simplest manner, consistent with comprehension, an interpretation of the Federal statutes concerning Trade Mark registration and protection. As the book is intended for business men, legal phraseology has been avoided as much as possible, as well as long quotations from court decisions, except where the inclusion of such excerpts was found necessary to a clear understanding of the subject. The Trade Mark is a most valuable asset, and it will pay every business man to know why such marks are valuable and why and how they should be protected. The booklet gives a thoroughly comprehensive idea of the requirements for registration. It tells what may and what may not be registered. The elements of a good Trade Mark are admirably and thoroughly discussed, and nine tests of a good Trade Mark are given. The following is a list of the chapters: Chapter I, The Trade Mark as a Business Asset; Chapter II, The Federal Trade Mark Law (Classification of Merchandise); Chapter III, Analysis of the Requirements of Registration; Chapter IV, The Elements of a Good Trade Mark; Chapter V, Trade Mark Protection; Chapter VI, Practical Information (which should be furnished) the Trade Mark Attorney. The book is beautifully printed in two colors on coated paper, and is illustrated by fifty engravings showing interesting Trade Marks. The price at which this book is sold is so small that it should have a place on every desk.

PER-ACIDS AND THEIR SALTS. By T. Slater Price, D.Sc., Ph.D., F.I.C. New York: Longmans, Green & Co., 1912. 8vo.; 123 pp. Price, 90 cents net.

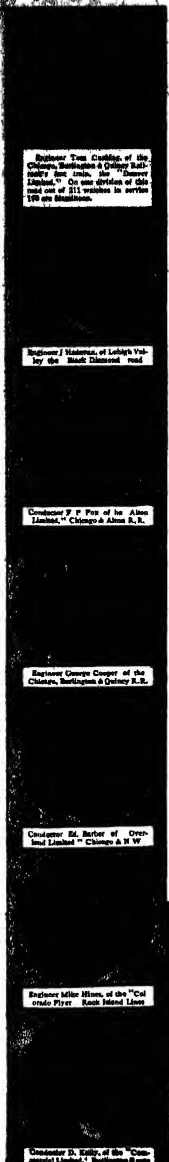
The series of monographs on inorganic and physical chemistry, to which this work belongs, is issued with the view of giving the advanced student adequate summarised accounts of progress along the most-traveled paths of endeavor. Out-of-date experiments and discoveries, interesting only from the historical point of view, are omitted in favor of recent investigations. The student undertaking research will find these issues of the greatest benefit to him in his work.

DIE URGESELLSCHAFT UND IHRE LEBENSFUERSORGE. Von Dr. Karl Weule, Direktor des Museums fuer Voelkerkunde und Professor an der Universitaet Leipzig. Stuttgart: Kosmos, Gesellschaft der Naturfreunde, 1912.

This volume is to be regarded as the third of a series on Anthropology written by the author. The first two dealt primarily with the origin and development of human culture or civilization. No attempt was made to trace the development of economical ideas. This the author has done in the present volume. He has given us a simply worded lucid little book that will be read with pleasure by those who have no desire to wade through the pages of a more pretentious technical work, but who nevertheless wish accurate information in a small text.

MEYERS HISTORISCHER HANDATLAS. 62 Hauptkarten mit zahlreichen Nebenkaertchen, einem Geschichtsabriss in tabellarischer Form und 10 Registerblaettern. Leipzig: Verlag des Bibliographischen Instituts, 1912.

This volume may be regarded as a splendid example of the map-maker's art. It must be a source of keen regret to every American scholar that it seems to be impossible to produce in this country maps which are as well executed mechanically and as accurate geographically as those which are produced in Germany. Of the sixty-two principal maps of which this volume is composed, twenty-two are devoted to ancient geography and the other two to mediæval and modern times. Special charts are provided to cover the last great wars. The atlas far transcends the rather narrow boundaries of most historical maps, covering as it does the history of colonial development and geographical discovery from ancient times until the present day. The rise of the British colonial empire, for example, is thus presented in a most graphic, we might almost say dramatic way. The more important maps which [illegible]



Engineer Tom Cushing, of the Chicago, Burlington & Quincy Railroad's fast train, the "Denver Limited." On one division of this road out of 211 watches in service 170 are Hamiltons.

Engineer J Haiseman, of Lehigh Valley the Black Diamond road

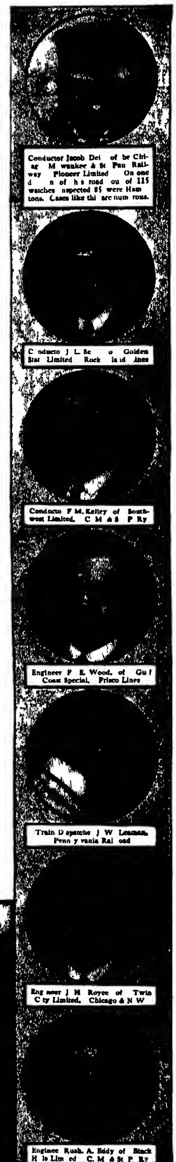
Conductor F F Fox of he Alton Limited," Chicago & Alton R. R.

Engineer George Cooper of the Chicago, Burlington & Quincy R.R.

Conductor Ed. Barber of Overland Limited " Chicago & N W

Engineer Mike Hines, of the "Colorado Flyer Rock Island Lines

Conductor D. Kelly, of the "Commercial Limited," Burlington Route



Conductor Jacob Dei of he Chicago M waukee & St Pau Railway Pioneer Limited On one d n of h s road ou of 115 watches nspected 85 were Ham tons. Cases like thi are num rous.

C nducto J L Se o Golden Star Limited Rock Is nd Lines

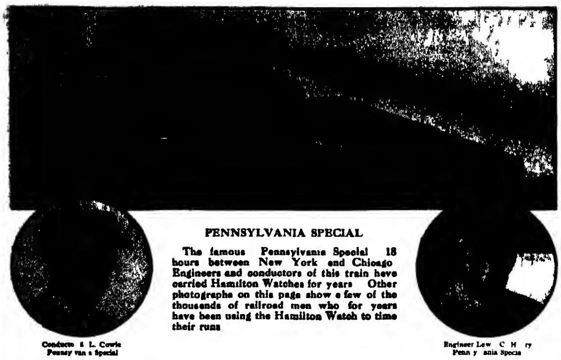
Conducto F M. Kelley of Southwest Limited, C M & S P Ry

Engineer P E Wood, of Gu f Coast Special, Frisco Lines

Train D spatche J W Leaman, Penn y vania Rai oad

Eng neer J H Royce of Twin C ty Limited, Chicago & N W

Enginee Rush. A. Eddy of Black H ls Lim ed C. M & St P Ry



PENNSYLVANIA SPECIAL

The famous Pennsylvania Special 18 hours between New York and Chicago Engineers and conductors of this train have carried Hamilton Watches for years Other photographs on this page show a few of the thousands of railroad men who for years have been using the Hamilton Watch to time their runs

Conducto S L. Cowle Pennsy van a Special

Engineer Lew C H ry Penn y ania Specia

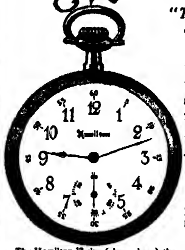
The Fastest Trains in America Run on Hamilton Watch Time

Over one-half of the railroad men on American roads maintaining Official Time Inspection carry Hamilton Watches

If you would experience the satisfaction and convenience of owning a watch of the unquestioned precision that railroad men demand, buy

The Hamilton Watch

"The Railroad Timekeeper of America"



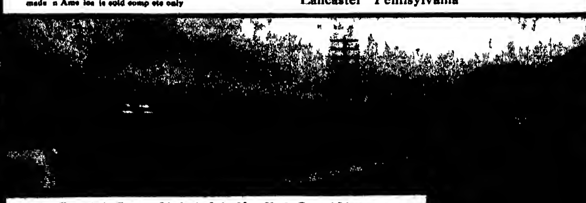
The Hamilton 12-size (shown here) the hinnest 19 o 23 jewel 12 size watch made n Ame ica is sold comp ete only

The Hamilton Watch is made in standard sizes for men and women and sold by leading jewelers every where at $38 50 to $150 00 for complete watches, timed and adjusted in the cases at the factory In some models movements only may be purchased so that using your present watch case you can own a Hamilton Watch for $12 25 and upward Ask your jeweler If he can not supply you write us

Write for "The Timekeeper"

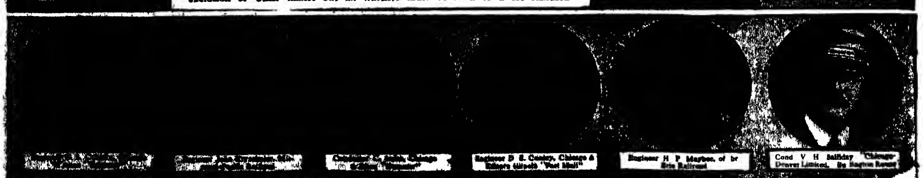
A book about watches that contains pictures descriptions and prices of all Hamilton models will be gladly sent to a y ne nterested in the purchase of a fine watch

Hamilton Watch Company
Lancaster Pennsylvania



The Twentieth Century Limited of the New York Central Lines and her engineer D R Woods who has carried a Hamilton Watch for several years

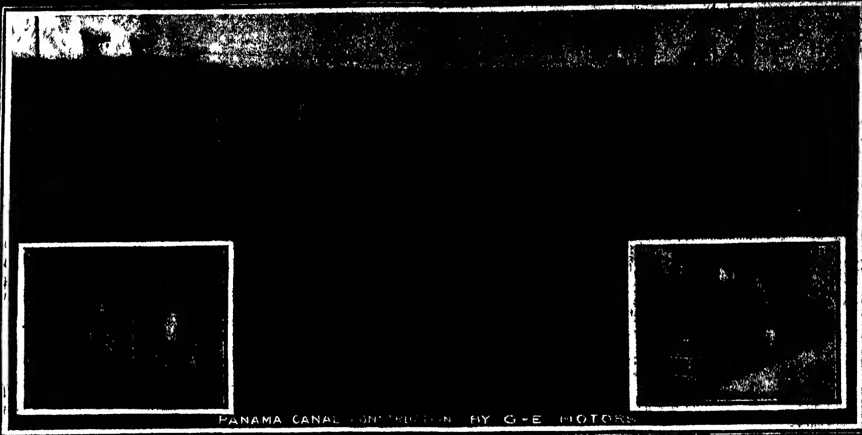
Most American railroads maintain on every division a rigid watch inspect on At regular intervals the watch of every employee of any responsibility must be submitted for examination and any watch that varies more than 3 seconds per day is ordered out of service No railroad ever "adopts" one make of watch to the exclusion of other makes but all watches must conform to a set standard



Engineer D S. Conley, Chicago & Eastern Illinois "Fast Mail"

Engineer H P Maybee, of he Erie Railroad

Cond V H Salliday "Chicago-Denver Limited, Bu lington Route"



Why Electric Power Was Selected

Electric power is playing an important part in the construction of the Panama Canal. It will be used to operate the completed canal.

A glance will show the magnitude of the completed canal and also how and why electric power is being used.

The Panama Canal is ranked as the greatest engineering feat the world has ever undertaken. It will be 50 miles long and vary in width from 300 feet at Culebra Cut to 1000 feet at Gatun Lake. Three locks at Gatun raise its level to 85 feet above the sea, one at Pedro Miguel lowers it 30 feet and two at Miraflores 55 feet more to sea level at the Pacific end.

Building the Canal

Water for a large part of the hydraulic excavation and fillings necessary for the canal and mammoth Gatun dam has been supplied by pumps driven by electric motors.

Both here and on the Catskill Aqueduct G E motor driven pumps have proven absolutely dependable even though working under adverse conditions. Each motor can be controlled by push buttons from remote locations if desired. This system requires but a small part of one attendant's time and does not draw upon the supply of compressed air or steam so necessary for drills at the workings. This method of operating pumps has proven so dependable and economical that American cities are using it in water plants. A number of cities are depending entirely upon electric pumps for their water supply.

Practically all the millions of yards of concrete used in the canal construction have been mixed by electric power and in many cases the cement, sand or broken rock has been crushed, unloaded, stored or conveyed by electric cars and G E electric locomotives.

Electric concrete mixers can be moved quickly to a new location because of the elimination of all weight not needed for strength, and the absence of a massive boiler. When relocated a simple electrical connection again permits operation with no delay.

There is no waiting to get up steam, no extra weight to drag around and the motors consume current only when they are working, thereby effecting power economy. Some of the advantages which determine the selection of General Electric motor drive in preference to the old donkey engines are: No water to be carried, no smoke nuisance, no fire risk, no firemen, no licensed engineer and no watchman. These advantages apply equally well in many cases to cranes, unloaders, etc.

On the Atlantic Division the mixed concrete is placed in the forms by electrically operated cableways which span the enormous cut or prism necessary for the canal. These cableways are operated with greater speed and certainty by the G E motors and control devices used than is possible with other forms of motive power, which unduly tire the operator.

On the Pacific Division concrete is placed by electric cranes of fixed cantilever, berm and chamber types as they move in the canal prism.

Electric power for all this construction work, the electric lighting and the searchlights used for night work on the Gatun cableway unloaders, etc., is furnished by two Curtis Turbine power stations.

Due to the intermittent character of most of the operations used in construction work, the demands upon an electric power station fluctuate, rapidly between quite wide limits. Curtis Turbines give a high economy throughout a wide range of loads and so are eminently fitted for this work. These turbines benefit fully from high steam pressure including superheat.

The vacuum maintained is 28 inches, something not generally considered possible in tropical countries with condensing water of 80° F and upwards. The advantages of the high vacuum used are completely realized. These turbines are constructed to withstand sudden changes of temperature incident to quick starting or to variations in superheat while running.

Permanent Operating Equipment

The entire operation of the canal will be by electric power furnished from a water power plant at the Gatun Spillway and from the Miraflores Curtis turbine section which will be maintained as steam auxiliary.

Electric power permits the control of all machinery at each group of locks from one lookout tower. The great flexibility possible from its use was the prime factor in determining the selection of electricity as a motive power.

The windings of the generators used in these stations are thoroughly protected from the effects of the moist tropical climate, by high grade insulation which was specially developed for the extreme conditions prevailing on the Canal Zone. They are built to run very cool and have the perfected G-E design features which are found in many of the largest power stations of the world.

Over a thousand electric motors will be used to operate the locks, gates, dams, gate protecting chains and to tow the ships through the canal by electric locomotives. Four powerful electric locomotives will move each ship through the canal. A sample locomotive is now under construction by the General Electric Company.

All the range lights will be electrically lighted, and the telegraph, telephone, fire alarm system and mining batteries offer additional opportunities for electricity to demonstrate its reliability.

Thus all the electric power used for building the canal and operating it when finished will be furnished by generators built by the General Electric Company. Practically all the electrical equipment purchased for the permanent operation of the Panama Canal was furnished by the General Electric Company.

General Electric Company

General Office: Schenectady, N. Y. 3851 **Sales Offices in All Principal Cities**

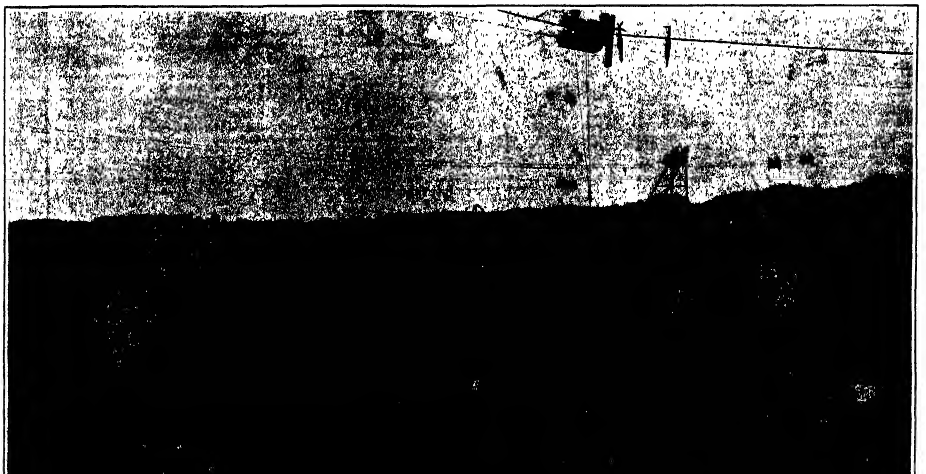
SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 19.] NEW YORK, NOVEMBER 9, 1912 [PRICE 15 CENTS $3.00 A YEAR

Gatun Dam—General view from water tower, showing south center approach wall, forebay of upper locks, the dam in process of construction, and the lake forming above the dam.



Constructing sidewall monoliths of the upper lock, Gatun. The concrete was placed between steel forms, movable on tracks laid on the floor of the locks.

THE GATUN DAM AND LOCKS.—[See page 386.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 9, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year ... Postage prepaid in United States and possessions Mexico Cuba and Panama	$3.00
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada one year, postage prepaid, ...	3.75

The Scientific American Publications

Scientific American (established 1845) .... per year,	$3.00
Scientific American Supplement (established 1876) . "	5.00
American Homes and Gardens .... "	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short* and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Man

WE speak elsewhere on this page of the special appliances which have contributed so greatly to the early completion of the Panama Canal. But what about the "man behind the" machine? No matter how great the excellence of an engineering plant, its output may be easily cut down by inefficient handling and a faulty organization of the working force. It took nigh upon forty thousand men to build the canal, and of this veritable army only a scattered few were natives of the soil. Literally, this was an army of invasion, carrying its attack into a country situated two thousand miles from its base. Not alone the men themselves had to be carried to a far distant and unfavorable field, and strewn out on a working front fifty miles in length, but with them had to be carried practically the very homes in which they were housed; and day by day the commissariat and quartermaster's department have had to forward from the United States, and distribute, the food and general supplies necessary for their maintenance at the front. In view of these facts, shall we be stretching the point too far when we say that the conquest of the Isthmus of Panama is a feat of the arms of peace, as brilliant and as difficult as any ever accomplished by the arms of war?

Continuing to speak in the terms of our analogy, it must be admitted that in its opening days, the campaign was not marked by that brilliant success which has distinguished its later phases. The period of civilian control was marked by doubt and disappointment. Wallace and Stevens, engineers of brilliant achievement, were beset with many difficulties, of which not a few were quite unnecessary. Chief among the latter was the hampering system of control, largely from Washington, which left these men without that absolutely free hand which is necessary for the successful execution of a work of this difficulty and magnitude. To both of these men, and particularly to Stevens, is credit due for working out a plan of organization which has contributed largely to the success of the work. But there was a lack of co-operation and absolutely unhampered central control which, if it did not threaten the ultimate success of the work, certainly promised to extend the time of its execution to an unconscionable length. The resignation and return to the United States of two civilian chief engineers in rather close succession presented an emergency which it took the clear insight and quick judgment and action of ex-President Roosevelt to grapple with successfully. He decided to place the whole work under army control, and thus subject it to an iron discipline against which there could be no appeal. Fortunately, he found in the Corps of Engineers of the army a highly expert body of men, who were already possessed of wide experience in works of civil engineering of a character generally similar to that at Panama. Need we go any further in this historical review? The fact that the canal will be ready for traffic over a year ahead of the time appointed, tells the story of the army's successful handling of this, the world's greatest engineering work.

In spite of some belated criticism, to which we do not attribute much value, it is generally agreed that one of the finest accomplishments of the Japanese people in the war with Russia, was their successful handling of the problem of sanitation. So, also, in this more peaceful but not less difficult campaign at Panama the cleaning up of the Canal Zone, and the extirpation and control of tropical fevers, as carried out under Col. Gorgas, must ever be considered as great an accomplishment in the field of sanitation as is the actual digging of the canal in the broad field of engineering. Not alone did the work of Col. Gorgas and his staff pave the way for the construction of the canal, but they have given an object lesson to the tropics in healthful living, whose benefits will be felt throughout the whole belt of the equatorial zone as long as time endures.

It was fortunate for the success of the enterprise that when Col. Goethals was placed in control as chairman of the Isthmian Canal Commission and chief engineer of the work, he was allowed to have such absolute control that he has himself spoken of his rule as a "benevolent despotism." To the vast advantages of army organization and discipline Goethals added all the force of an unusually strong personality. His enthusiastic devotion to the enterprise, coupled with a magnetic personal interest in the working force, have found a quick response among the men—engineers, mechanics and laborers alike, who have so loyally co-operated to push the great work so rapidly to its completion.

The Machine

THE predicted completion of the Panama Canal some fifteen months earlier than the date originally estimated, is a distinct tribute to the efficiency of American labor-saving machinery as exemplified in the steam shovel, the plow unloader, and the high-speed cableway. Other labor-saving devices, it is true, have contributed to the great result; but so far as the mechanical appliances at the canal are concerned, the three named above stand out as giants among their fellows. Outside of the problem of sanitation, the solution of which when the United States took hold of the job was immediately recognized as imperative if the canal was ever to be built, the difficulties of the task were rather those of quantity than of quality. In spite of much that has been said to the contrary, particularly in the early days of our occupation, when disappointed engineers and contractors did not hesitate to say that the construction of the canal at Panama was fairly bristling with engineering difficulties of a new and altogether untried character, it is a fact that, judged from the engineer's standpoint, the work at Panama differs from the general run of hydraulic and excavating problems in the United States only in respect of its magnitude and of the trying climatic conditions under which it is carried on. In one respect indeed, that of financial backing, the work of the builders of the canal has been rendered much easier than similar work of an engineering character as carried on at home. Requisitions for men, materials, and money have met with instant and liberal response from Congress; and just what this means will be well understood by those engineers who have had charge of important contracts, city, State or otherwise, in which the element of rapid construction was given prime importance.

At the very outset of the work, it was realized that the two controlling sections as regarded the time of completion were the Culebra cut and the locks and dams at Gatun. The former was a question of rapid excavation and speedy and uninterrupted disposal of the spoil. The latter was a question of the rapid handling, mixing and laying in place of the largest amount of concrete that had ever entered into a single job of this character. It was predicted, at first, that the cut would be finished before the locks, and it was believed that the latter could not be completed in time to allow of an earlier opening of the canal than January 1st, 1915. Because of the unprecedented dimensions of the locks, the engineers realized at once that existing cableways and other means of transport possessed neither capacity nor speed commensurate with so great a task. The old designs which had done such good work on the Chicago Drainage Canal were redrawn and dimensions and speeds were greatly increased. The work of concreting was no sooner in full swing, than it became evident that the locks would be finished a year or two before the date originally set. With the new handling facilities, the rock, sand and cement and mixed concrete were swung to and fro in mid-air in buckets of three to five tons capacity and at speeds of twenty miles an hour and over. In a single day, and for days together, an average of three thousand yards of concrete was laid, the total on more than one occasion reaching four thousand yards.

What the cableways accomplished at the locks in expediting the work was equaled if not surpassed by the work of the steam shovel and the plow unloader at Culebra cut. Not only were the largest shovels capable of taking out five to six tons at a scoop, but these machines were pushed closer to the limit of their endurance than is ever attempted in the United States. The time element was the controlling factor. Because of heavy overhead charges, it was realized that wear and tear of plant was a small consideration where months and even years of time could be saved.

The problem of disposal of the excavating material was as great as, if not greater than, that of digging it out, and from Culebra alone 160 loaded trains per day, involving the services of 115 locomotives and two thousand cars, were hauled to the dumps, a distance from one to thirty-three miles from the point of excavation. Here, that other ingenious invention, the plow-unloader, performed admirable service. Trains of twenty-one cars, carrying six hundred tons of material, were swept clear of their loads in from four to six minutes time. Such methods of digging, loading and unloading, coupled with a most admirable track lay-out, soon showed their effect in the total yardage handled; and it was not long before the material was being dug out and dumped at the rate of from 3,000,000 to 4,000,000 cubic yards per month. Had it not been for the unexpected developments of the slides, the whole of the excavation in the great cut would have been finished at the beginning of the present year. The steam shovel, the dirt train, the unloader, and the overhead cableway have established a record for the Panama Canal which will probably remain for many a decade to come.

The Proof of the Pudding

TO the bacteriologists of the Bureau of Chemistry, we commend a paper which appears in the *Journal* of the American Medical Association for October 26th, 1912, from the pen of Dr. W. T. Sedgwick, the professor of Biology and of Public Health in the Massachusetts Institute of Technology. We are aware that this suggestion is not likely to be received with enthusiasm; for Prof. Sedgwick has long been opposed to the wholesale destruction of foods because they are merely of inferior quality and has insisted that Government supervision should preserve and make safe such products. Moreover, we can see immense possibilities in cunningly twisting Dr. Sedgwick's article on "The Fallacy of Testing Food Materials by Animal Inoculation" into a hearty recommendation to eating rotten eggs and a splendid indorsement of putrid food in general.

The point that Dr. Sedgwick makes in his paper is simply this: A food is not necessarily unfit to eat because, when injected beneath the skin, it may kill an animal. Although Dr. Sedgwick does not say it, we have no doubt that subcutaneous injections of many pure foods would prove fatal to lower animals. Every physician knows that a quantity of morphine which, taken hypodermically, would kill very quickly, can be swallowed with impunity. The toxins of diphtheria, tetanus, typhoid, and other infections act either comparatively feebly or not at all when taken by the mouth. So, too, the germs of lockjaw and anthrax, two of the worst diseases that afflict the human race, can be eaten; but they may not be injected with the hypodermic needle without incurring terrible results.

In face of all this, in face of the fact that the purity and salubrity of drinking water is no longer determined by injection, "certain Government bacteriologists," as Prof. Sedgwick euphemistically refers to the Bureau of Chemistry's pseudo-scientists, seek to revive this discredited "test"—not only for water, but for eggs, oysters, ice cream, gelatines, and other condiments.

Prof. Sedgwick is probably the last man who would advocate the eating of decomposed eggs, or would himself prefer a cold storage egg to the "newly laid" of the barnyard fowl. But he cannot refrain from arguing that the long experience of the trade and of consumers of eggs, particularly of those bakers who have used cold storage eggs in pies, cakes, and custards, without perceptible injury and with results no different from those obtained with fresh material, should not be brushed aside in favor of the data obtained by a scanty and questionable experimentation which consists not in feeding animals as man is fed, and not after cooking the food, but in directly injecting large amounts of the raw and uncooked substance beneath the skin or into the delicate peritoneal cavities.

The alimentary canal is very ingeniously designed. Special walls prevent the absorption of the undesirable components of foods, leaving to the intestines the task of casting them out. Not only does cooking profoundly affect food, destroying as it does most bacterial life, not only does the stomach chemically change food, raw as well as cooked, but the direct injection of raw food into the body beneath the skin becomes, as Prof. Sedgwick says, "a crude and severe procedure, a kind of rough surgical interference, totally different from the normal taking of the same materials into the body by way of the food tube—perhaps already cooked." To determine the fitness or unfitness of an egg or an oyster it must be swallowed. The proof of the pudding, in other words, lies in the eating. If an animal dies because it has been inoculated with food, no scientific light is shed on the purity or healthfulness of the material injected. Besides, a vast quantity of food is destroyed which in these days of the high cost of living can ill be spared.

Fortifying the Canal

A Legal Right and a Matter of National Expediency

By Henry L. Stimson, Secretary of War

WHEN President Taft first urged upon Congress the necessity of fortifying the canal, criticism was made that such action would be a breach of our obligations to Great Britain under the Hay-Pauncefote treaty. The publication, however, of the correspondence between Mr. Hay and Lords Pauncefote and Lansdowne completely silenced this criticism; and I do not think that our legal right to fortify the canal is now seriously questioned. It may, nevertheless, be well to summarize briefly this legal situation.

I. Our Legal Right to Fortify the Canal.

In the Clayton-Bulwer treaty of 1850 the United States and Great Britain expressly agreed not to fortify or assume any dominion over any part of Central America where the canal might be made. The first draft of the Hay-Pauncefote treaty of February 5th, 1900, contained a similar prohibition to the effect that "no fortification shall be erected commanding the canal or the waters adjacent." This proposed treaty in this form was rejected by the Senate for the very reason that it did not give the United States sufficient liberty of action in regard to the canal. The present Hay-Pauncefote treaty was then negotiated, which in its first article entirely abrogated the old Clayton-Bulwer treaty, and also omitted the restrictions against fortification which had been contained in the first proposed Hay-Pauncefote treaty.

The memorandum which Mr. Hay sent to the Senate with the second Hay-Pauncefote treaty, containing the correspondence between himself and Lords Pauncefote and Lansdowne, shows that these changes were made for the express purpose of permitting the United States to fortify and defend the canal, and that Lord Lansdowne fully understood and recognized this right on our part. As to this, Lord Lansdowne expressly said:

"It is most important that no doubt should exist as to the intention of the contracting parties. As to this, I understand that by the omission of all reference to the matter of defence, the United States Government desires to reserve the power of taking measures to protect the canal, at any time when the United States may be at war, from destruction or damage at the hands of an enemy or enemies."

The Congress of the United States then proceeded the following year in the Spooner act (Section 5) to authorize the President to enter into the contracts for the construction of the canal and its "defences." And in the following year, 1903, Mr. Hay, the same statesman who had negotiated the Hay-Pauncefote treaty, negotiated a treaty with the Republic of Panama by which Panama granted to the United States for the purpose of the canal the use, occupation and control of the present Panama Canal Zone, and also granted to the United States for the protection of such canal, the right to use its land and naval forces and to establish fortifications. (Bunau Varilla treaty, Article XXIII.)

The Hay-Pauncefote treaty and the Bunau Varilla treaties are the only existing treaties entered into by the United States which affect its rights over the Panama Canal. It is perfectly clear, therefore, from the foregoing facts, that none of the statesmen, either of Great Britain or Panama or the United States, who were concerned at the time in the negotiation of these treaties or the enactment of legislation to make them effective, had any doubt as to the right or purpose of the United States to defend and fortify the canal.

II. The Necessity of Fortifying the Canal as a Matter of National Expediency.

There has also been much misconception as to the expediency of fortifying the canal as a national policy. It has been earnestly argued that the safety of the canal can be better and more cheaply assured by an agreement between the leading nations, making it a neutral waterway and forbidding it from ever being blockaded or seized in time of war. It is argued that such a course will relieve us from the expense and burden of defending the canal, and that it will at the same time accomplish every result which we could accomplish by defending it ourselves.

This is an entire misconception. It loses sight of the vital difference between an American canal and an international canal. It loses sight of the fact that it is of vital importance to this country not only that the canal shall be open to our fleet in case of war, but that it shall be closed to the fleet of our enemy. An international canal, kept open and defended by agreement between the powers, from its very nature would have to be open to our opponent as well as to ourselves.

Let us look into this a little more in detail. The Panama Canal, when completed, will shorten the distance between our east and west coasts from 13,000 miles to 5,000 miles. The long peninsula of South America, stretching down nearly into the Antartic Ocean, offers an almost insuperable obstacle, not only to the transfer of our own fleet from one coast to another, but to a similar transfer of an enemy's fleet. In these days of dependence upon coaling stations, it would be almost impossible in time of war for the fleet of a nation to which such stations were not available to pass around that long and sparsely inhabited coast. Thus, the populous cities in our eastern coast are almost absolutely protected against sea raids from an enemy in the Orient. And similarly the great cities of our western coast are protected against the forays of a European fleet. To a peaceful national like our own, maintaining a very small regular army, this condition is most important. In case of war it enables us to concentrate our entire defence upon the threatened side, and it thereby tends to give us the absolutely necessary time which will be required in order to create and train a citizen army. Our regular army is insufficient in size even to protect adequately one frontier. If it had to cover two, its efficiency would be reduced

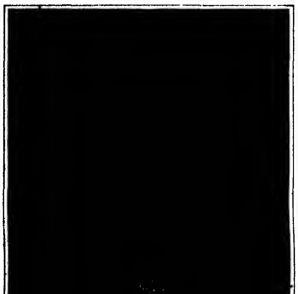


Photo. by Pach Bros.

by half. The three months which would be consumed by a foreign enemy in going around Cape Horn, or through the Straits of Magellan, might make the difference between a successful defence or complete disaster on the part of those communities against which the attack was intended.

On the other hand, if, in case of war, our enemy's fleet were free to pass through the Isthmus of Panama and to transfer its activities from coast to coast at will, we should be in a very much more defenceless position than we are to-day without the canal. That very possibility would make necessary additional expenditures on our military and naval establishments which would far exceed the cost of fortifying the canal.

It is this feature of the canal which has been almost wholly lost sight of in the discussion as to fortification. We have all been quick to realize the immense naval advantage which the canal is to ourselves. Ever since the voyage of the "Oregon," we have all readily seen how the existence of the Panama Canal in case of need may be equivalent to doubling the size of the American fleet. We have not borne in mind the similar advantage which the canal, if open, would be to our enemy. We have not remembered that it would destroy the tremendous protection which the continent of South America is to us at the present day. We have not remembered that it would be almost as long a step toward depriving us of our insularity, and bringing us into the embroilments of European and Oriental nations, as the invention itself of steam navigation.

It is interesting to follow in the development of the treaties and legislation in respect to the canal, how slowly this idea developed even on the part of those responsible for the government of the country. In 1850, when the Clayton-Bulwer treaty was negotiated, the paramount interest of the United States in the proposed canal was not recognized in the treaty. Our Pacific Coast had only just been opened for settlement. The whole structure of the treaty admitted an equal interest on the part of England with ourselves in the canal. The treaty expressly provided that, even in case of war between Great Britain and the United States, the waterway was to remain open to both belligerent parties. The great development of the United States as the dominant western power, and its modern supreme interest in the Caribbean Sea, were apparently undreamed of.

Even in 1900 the first draft of the Hay-Pauncefote treaty failed to grasp and define this cardinal fact. While that treaty paved the way for this country to incur the expense of building the canal, it did not secure the vital *quid pro quo* which that expenditure merited. It did not take the decisive step which made it an American rather than an international canal. We owe it to the Senate that this result was finally secured, and that Great Britain was brought to recognize that while the canal was a great commercial convenience to the rest of the world, to us it was a vital military asset. That this recognition was clearly and frankly and cheerfully made is evidenced by Mr. Hay's notes of the negotiation subsequently transmitted to the Senate, in which he says, in respect to the omission from the second Hay-Pauncefote treaty of the words, "in time of war as in time of peace:"

"No longer insisting upon the language of the Davis amendment, which had in terms reserved to the United States express permission to disregard the rules of neutrality prescribed, when necessary to secure its own defence, which the Senate had apparently deemed necessary because of the provision in Rule 1, that the canal should be free and open 'in time of war as in time of peace' to the vessels of all nations—it was considered that the omission of the words, 'in time of war as in time of peace' would dispense with the necessity of the amendment referred to, and that war between the contracting parties, or between the United States and any other power, would have the ordinary effect of war upon treaties when not specially otherwise provided, and would remit both parties to their original and natural right of self-defence, *and give to the United States the clear right to close the canal against the other belligerent and to protect it and defend itself by whatever means might be necessary.*"

The foregoing considerations show the vital relation of the canal to the interests of the United States, and bring out the force of the remark of President Hayes, in his special message to Congress, dated March 8th, 1880, that the canal will be "virtually a part of the coast line of the United States."

As a matter of fact, it is far more vital than any particular portion of the coast line or any seaport, however important, because it is the key to the protection of many seaports and thousands of miles of coast line. It is far more vital to us than the Suez Canal is to Great Britain, because the Suez Canal affords communication not between the integral parts of the British Isles, but between those Isles and India, an alien nation, and a slightly shorter route to Australia, a colony, than is afforded by the route via the Cape of Good Hope. England possesses, moreover, numerous well defended bases and coaling stations on the route to southern Asia via the Cape of Good Hope, so that the closing to her of the Suez Canal would not interrupt her water communication either commercial or military even with India. The relation of the Panama Canal to the United States is far more analogous to the relation of the Kiel Canal to Germany; yet even here the analogy is not complete, for important as the Kiel Canal is to German commercial and military interests, its interruption or seizure by an enemy would lengthen the sea route for German war vessels by only a few hundred miles instead of by 8,000 miles.

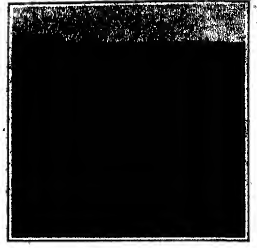
Assured control of so vital a possession is evidently an indispensable condition of our national security. In determining the measures which will be found most effective to accomplish this result, we naturally turn to a contemplation of the means and measures which have been employed almost invariably throughout the

(Concluded on page 399.)

Upper lock gates; Gatun Lake water in foreground.

The Gatun Dam and Locks

By Lieut.-Col. William L. Sibert, Corps of Engineers, U. S. A., Member Isthmian Canal Commission, Division Engineer Atlantic Division



Piers, west wing wall, which will break up wave action.

THE first authoritative recommendation for building a dam across the valley of the Chagres at Gatun was made in the minority report of the Board of International Engineers, convened by the President of the United States for the purpose of studying and making recommendations concerning the best type of canal across the Isthmus of Panama. This minority report recommended a lock canal with a lake 85 feet above the sea, formed by the Gatun dam.

The Chagres valley at this place is 7,920 feet wide, including a hill in the center in which existed suitable rock for founding a concrete dam for a spillway. Geologists state that the Gatun dam site was, at one time, 300 feet higher than now, and that during the period of this elevation the Chagres River cut gorges through the site toward the sea; one on either side of the Spillway Hill. After the subsidence referred to, the dam site was built up, evidently in an arm of the sea; portions of this sedimentary fill being of the finest clays. The low elevation of rock in these old gorges practically precluded any other type of dam than an earthen one. The supporting power of the material underlying the proposed earthen dam was not definitely known at the time of the submission of the minority report referred to above, and a section was recommended in this report, which presumed that there was a hard bottom underlying the lake face of this section.

An early study of the material available for hydraulic fill in the dam led to the belief that the slope on the lake face should be flattened in order that the hydraulic material might be stable when placed. This led to the first proposed change in the section of the dam, which was to construct a rock ridge at the toe of the lake side, of such height as would insure a slope of about one fifth from the top of this rock ridge to a reasonable height above the lake level. Work on other parts of the canal soon gave rise to the thought that another, and probably a controlling, element should enter into the design of this section; that element being the bearing capacity of the material underlying the dam. It was finally thought that the best and most economical section for the dam was probably one of uniform slope on both faces, thus making no violent change in the loading on any part of the foundation. The cross-section on the adjoining page approximates that condition, and is the section now tentatively adopted. The original height proposed for this dam was 135 feet above sea level. The approved height is 115 feet above sea level, while the tentative height to which the dam is now being built is to be not less than 105 feet above sea.

Construction.

The first operation in the building of the dam was to stop the flow of the Chagres River through its old channel next to the locks and through the old French canal, forcing the entire flow through a channel known as the "West Diversion," west of the Spillway Hill. (See general plan of the dam.) Trestles were then constructed on the 30-foot contour on both faces of the dam, and waste rock dumped by trains from such trestles, forming embankments between which the hydraulic material was pumped. (See photograph.) No trouble was encountered in closing these two channels; both they and the west diversion channel being at sea level. After the accomplishment of this, the excavation of a channel through Spillway Hill and the construction of that portion of the dam between Spillway Hill and the lock site, were commenced.

As the work progressed, and the dry fill commenced to overlap the underlying hydraulic fill, an effort was made to give such dry fill a face of about 15 feet above the wet fill. The thought was that this height of material, with loaded trains running over it, would compact the hydraulic fill and force to the center any very soft material, the softest of which would be taken out by the drain pipes. These drains (20-inch pipe), the function of which was to remove the surface water from the hydraulic fill "pond," were placed in such a way as not to endanger the stability of the dam. By varying the depth of the "pond" a greater or lesser amount of the finer clayey material could be removed.

One of the greatest construction difficulties has been the excessive amount of clay in the material available for the hydraulic fill. An excess of clay makes a water-tight fill, but such a fill drains itself very slowly, and, consequently, remains soft for a long time and increases the difficulty of making the overlying dry fill. An excess of clay also means that the slopes of the dam must be flat to insure stability in so far as the hydraulic fill itself is concerned. The east half of the dam, for a considerable portion of its length, has been practically completed for some months with every indication of perfect stability. A slow consolidation of the great mass of material forming the dam is going on and will probably continue for some time to come. The lake stands now at about 50 feet above sea level.

The permanent spillway channel, with concrete bottom and side walls, founded on rock, together with such preliminary work as could be done on the foundations of the spillway dam proper, was completed on April 24th, 1910, and the work of diverting the Chagres River from the west diversion channel to the spillway commenced. The elevation of the spillway channel is 10 feet above sea level, consequently in any attempt to stop the flow of the Chagres and force it through this channel, a rise of about 14 feet of water had to be encountered. The banks and bottom of the west diversion were soft clay. The plan adopted was to drive trestles across this channel on the 30-foot contour on each face of the dam, and to build, by dumping rock directly into the stream, two dams at the same time, hoping to distribute on such dams the head formed during construction. An unlimited amount of waste rock was available for this work. The banks of the channels were first made secure by dumping rock at the end of the trestles. After the channel was contracted to some extent, a considerable current developed; rock dumped from the trestles was carried some distance down stream, forming a rock apron in the bed of the stream below the dam. Quite deep holes, however, were dug by the water below this rock apron. When the work on the two dams had progressed so that a channel about 80 feet wide and 6 feet deep was left in the center, it was found impracticable to make any headway. Stone dumped from the trestles would be rolled down stream. The rainy season was then about to commence. The lower part of the bents of the trestles being well supported with rock, it was then decided to dump a carload or two of crooked rails above the trestles in such a way that they would form an entanglement and stop the rock, thus insuring either the construction of the dam or the taking out of the trestle. By this means the two dams were finally completed and the Chagres River successfully diverted.

Bird's eye view of Gatun locks, dam, and spillway, showing ships being towed through locks by electric locomotives.

Before turning the water through the spillway channel, stubs of piers, 20 feet apart, were built of such height that their tops would be exposed in the dry season. When the work of constructing the masonry dam in the spillway was commenced, these piers were immediately run up to an elevation of 45 feet above sea level and tracks for locomotives, cranes and trains laid on a bridge resting on these piers. Grooves were made near the lake end of these piers into which weighted timber curtains could be lowered by crane, so as to stop the flow of the river. This arrangement gave complete control of the Chagres and allowed the construction force to shut off any portion of it at any time they saw fit. Concrete was dumped between the piers directly from cars, and the lower part of the ogee was formed by dumping it into hoppers and conveying it to place through chutes. The masonry at each end of this dam is now to its full height excepting the piers between which the Stoney gates for controlling the lake level will be placed. The central portion of the dam, about 400 feet long, has been built up to elevation plus 50, over which elevation the water will be allowed to run during the coming rainy season.

For controlling the water, partially through the rainy season and entirely during the dry season, during construction, three openings 8 by 18 feet were temporarily left through the heavy masonry part of the dam, and Stoney gates of the same size as those used in the large culverts of the locks placed in these openings. Opening these valves next dry season will soon lower the lake level below the completed concrete and permit

the completion of the work. A cylindrical valve, of the type used in the locks, was also placed in this dam for experimental purposes.

Gatun Locks.

Raising ships to the lake level portion of the canal, which is 85 feet above sea level, is accomplished by a duplicate flight of three locks. Each lock has a lift of 28 1/3 feet, and will pass ships 1,000 feet long, of 40 feet draught and approximately 110 feet wide.

The locks proper are founded on rock and the heavy masonry is completed. This rock foundation was not of sufficient extent, however, at available elevations, for supporting the guide walls. Under that guide wall extending into the lake (see photo. on front page) the underlying rock at the south end is about 150 feet below sea level, and the overlying material is soft. This wall is cellular in construction. It is composed of four longitudinal walls about 2 feet thick with cross walls about 17 feet apart, all built of reinforced concrete.

The natural ground underlying the wall was about 8 feet above sea level. On this ground a wide fill with a very flat slope was constructed to elevation plus 35 and through this piles about 60 feet long, 4-foot centers, were driven and a heavy reinforced concrete slab built around the heads of the piles, on which was erected the cellular structure. There was a continual slow settlement of this wall as its construction progressed. It was brought to a height of 61 feet above sea level through its entire length in order that the settlement might extend over the whole base before any part was brought to full height. At one time it showed an inclination to settle toward the east. This was corrected by pumping water into the west line of pockets and so maneuvering the water load as to make the wall settle vertically. This wall is now full height and stable, and the lake is rising around it, which will add to its stability.

The north guide and flare walls are yet to be built. It will be necessary to go to a depth of about 70 feet below sea level through very soft material in order to uncover the rock on which to build the flare walls. Under the guide wall itself the rock is at a still lower elevation, and a pile foundation will probably be constructed, the piling going to rock. The material in this space was too soft to hold up steam shovels, and it was decided to do the general excavation by suction dredges. These dredges cut their way into the space where the walls in question are to be built, making a channel just wide and deep enough for their passage. They then widened out the cut and deepened it to 41 feet below sea level. An earthen dam was then built across the narrow entrance cut, shutting off the connection with the sea, and as the dredges worked they were lowered. They are now floating at an elevation of 32 feet below sea level and can remove the material to the depth required. After the excavation is completed it is proposed to have the dredges excavate a sump 65 feet below sea level and lower the water to 50 feet below sea in order to test the stability of the sides of the cut. If there is no sliding the pit will be filled with water; the dredges floated out, the dam across the entrance channel replaced and the excavation unwatered for the construction of the walls first referred to.

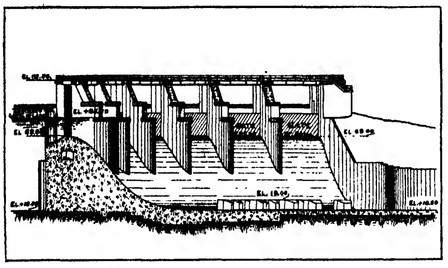
In the explorations made by diamond drills to determine the character of the foundations for the locks proper, the entire space was thoroughly covered by holes. After the character of the rock was determined, experiments were made to find out whether or not the underlying material was creviced so as to allow the passage of any material amount of water. These experiments showed that the crevices in the rock were very small, but that there might be sufficient passageway to transmit pressure under the lock floors. This resulted in constructing a floor in the upper lock, between the emergency dam sill and the intermediate gate that would resist full lake pressure, if received. Behind the remaining lengths of lock walls, drains of large stone were provided, and the corresponding floors made thin.

The operation of these locks differs from that of the ordinary lock. First: In that ships will not be allowed to enter and leave the locks under their own steam. They will be required to land along the side of the guide walls and will be taken in tow by four electric traction cars (see bird's eye view of locks and dam) and thus taken through the flight of locks. These cars, while under load, will be operated on a rack track; returning light, they will run on an ordinary track except when making the descent from one lock level to another. Second: Duplicate operating gates are provided at each end of the locks that connect with the lake level. These gates will be operated simultaneously so that if one gate is broken or damaged there will be a good pair of gates in position, and in addition, there is placed above each set of gates in the upper lock and below the sea gates of the lower lock, fender chains. These chains will be kept in such position as to bar the passage of a boat into the lock until it is ready for the boat to enter. Then the chain will be dropped into a slot in the floor.

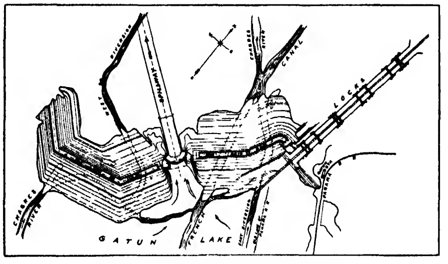
A swing-bridge emergency dam is provided for stopping the flow of water through the locks in case all of the gates in the upper lock should be opened or broken, so as to allow the passage of water.

Construction.

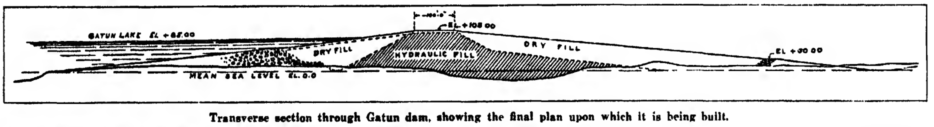
The masonry of the Gatun locks was largely placed by cableways, having a span of 800 feet, covering the entire space to be occupied by the locks. The stone and sand for the concrete were obtained, respectively, 20 and 40 miles down the Caribbean coast, and were brought in barges up the old French Canal as closely as possible to the lock site, and were unloaded by cableways into large stock piles near the bank. The material, however, was still 3,500 feet away and 60 feet below the center of lock construction. This situation caused the adoption of a central mixing plant near the central portion of the locks, consisting of eight 2-yard mixers. An automatic, electric, loop-line railroad, each car carrying the material for a batch of concrete, was installed, passing under the cement shed; under the sand and stone piles, and over the mixers. The mixed concrete was delivered to the cableways requiring it by an electric line, the flat cars of which were handled by electric locomotives. Steel forms (see front page engraving) were used in constructing the walls of the locks.



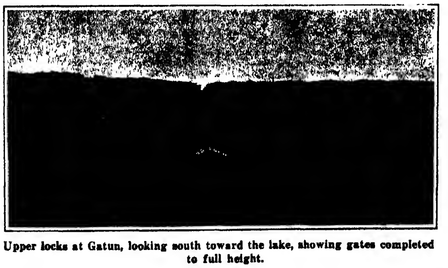
Section through center of Gatun dam spillway.



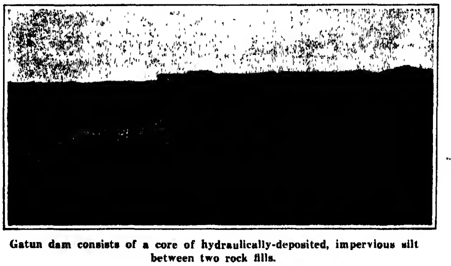
General plan of Gatun dam, locks and spillway.



Transverse section through Gatun dam, showing the final plan upon which it is being built.



Upper locks at Gatun, looking south toward the lake, showing gates completed to full height.

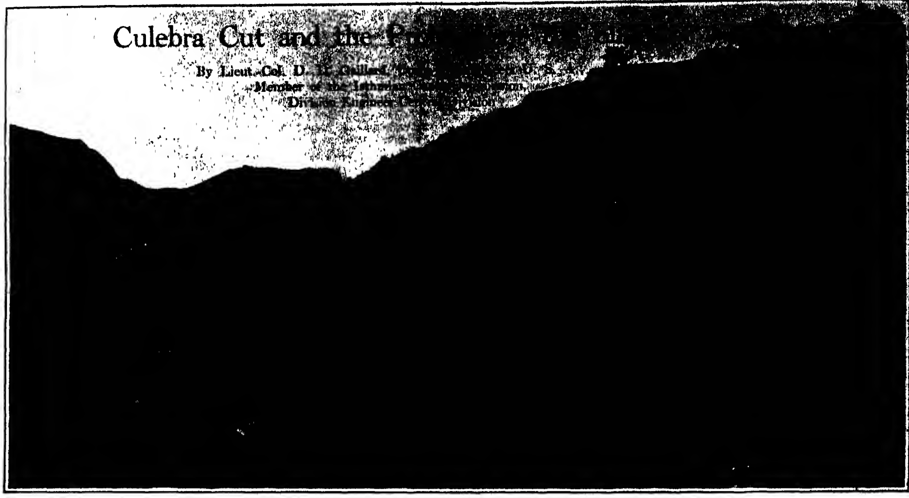


Gatun dam consists of a core of hydraulically-deposited, impervious silt between two rock fills.

Belgian Taxicabs Must be Mud-proof.—Following the campaign of several of the automobile clubs of France and Belgium against the carelessness of drivers who bespatter pedestrians with mud and slush on rainy days, the city authorities of Anvers have issued an order compelling each taxicab to be fitted with a mud-shield, protecting the passer-by from mud thrown aside by the wheels. The style and shape of the protector is not definitely stated, it being left to the individual taste of the owner of the cab. All that the city fathers ask is that it be effective, elastically supported and of pliable material.

Culebra Cut and the P[illegible]

By Lieut.-Col. D. D. Gaillard, [illegible] U. S. A.
Member of the Isthmian [illegible] Commission,
Division Engineer, C[illegible] Division



Slide on west bank of the cut, Culebra, September 27th, 1912, looking south toward Gold Hill. This slide occurred about August 25th, 1912, and involves about one and a quarter million cubic yards of moving material. It is composed wholly of clay and occurs where a natural pocket of this material existed.

THE Central Division, of which the writer has been in charge since April, 1907, extends from Gatun dam to Pedro Miguel locks, a distance of 31.7 miles, and embraces the entire summit level of the canal, the water surface of which is 85 feet above sea level.

For administrative purposes, the Central Division was divided into two parts, known as the Chagres section and the Culebra section—the latter being generally known as the Culebra cut. This section extends from the Chagres River at Gamboa to the Pedro Miguel locks, a total distance measured along the axis of the canal of 8.8 miles, and comprises the natural summit of the water shed which separates the Pacific Slope from the Caribbean Slope, and culminates in Gold Hill on the east bank of the canal and Contractor's Hill on the west bank. As a consequence, this comparatively short section embraces nearly one half of the total excavation required for the entire waterway between the Pacific Ocean and the Caribbean Sea.

Actual excavation on this section was commenced by the French in January, 1882. The plan under which the greater part of their work was carried out was for a sea level canal, 72.16 feet in width at the bottom and 27.9 feet in depth. Owing to financial and physical difficulties, this project was modified in 1887 to a lock canal with ten locks and with a summit level 160.7 feet above sea level, and, with the exception of the period between May, 1889 and October, 1894, work was carried on continuously in the Culebra cut, first by the "Old French Company" until it failed in 1889, and later by the "New French Company," with greatly diminished forces, until the United States assumed control in May, 1904.

From the commencement of operations by the French until the canal was acquired by the United States, a total of 21,588,520 cubic yards of material was excavated within the limits of the Culebra cut, of which 20,419,720 cubic yards form a part of the present approved project.

This project in the cut is for a canal with a minimum width of 300 feet on the bottom, a minimum depth of 45 feet and a width on the water surface of 300 feet. To secure these dimensions in the Culebra cut, it is now estimated that it will be necessary to excavate in all about 115,000,000 cubic yards of material, including the useful French excavation, of which about three quarters is classified as rock.

When the United States acquired control of the canal in 1904, the entire force of laborers who had been working under the French Company, about six or seven hundred in number, were transferred to the United States' pay-rolls, thus preventing any actual cessation in the work of constructing the canal. This original force was increased from time to time until it attained its maximum in March, 1911, during which month the average daily working force in the Culebra cut, and on the dumps connected with it, was about 900 Americans and 7,300 European and West Indian laborers.

The engineering problems connected with the work are handled by the engineering force, under a resident engineer. In addition, there is a superintendent of transportation, who handles all transportation matters in the Central Division, and a superintendent of the water and air service, who sees that all shovels, drills, pumps, etc., are connected with water and air mains. That these positions are no sinecures may be inferred from the fact that in the one case over 1,000 loaded and empty trains have been handled in the Central Division in a nine-hour day, and in the other, an average of two miles of water and air pipe is laid and two miles taken up, for every working day in the year.

As most of the material to be excavated consists of rock varying from very soft rock, which readily disintegrates on exposure to the atmosphere, to very dense rock of great hardness, it is necessary before this material can be excavated, that it be drilled and blasted. Two kinds of drills are used in this work—tripod drills and well drills, and both obtain their power from a 10-inch compressed air main on the west bank of the cut, running parallel with the same. This main is supplied by three batteries of air compressors located at equal distances along the ten miles of main. All excavation in the cut is done with steam shovels with 3-yard and 5-yard dippers, the latter being used almost entirely. The order of operation is as follows: Drill holes are placed normally about 14 feet apart and staggered. Their usual depth is about 27 feet, being three feet deeper than the depth to which the shovel excavation is to extend. When these holes have been completed, they are loaded with 45 per cent potassium nitrate dynamite, in suitable quantities, depending upon the character of the rock. A group of holes are connected "in parallel" and fired by means of a current from the electric lighting plant. The shovel then follows at a suitable distance and loads the material onto steel cars, which are dumped by hand, or on Lidgerwood trains, from which it is plowed off at the dumps by means of unloaders, and plows weighing from 14 to 16 tons.

The maximum number of drills in use at any time in the Culebra cut was 377, of which 221 were tripod drills and 156 were well drills. With these drills, an aggregate of over 90 miles of holes have been drilled in a single month. In blasting operations, a pound of dynamite is now used to about every 2¼ cubic yards of material blasted, and the quantity of dynamite used per annum in the Culebra cut for several years past has averaged about 6,000,000 pounds. The greatest number of shovels in use at one time in the cut was 43, and the greatest monthly excavation in any single month was obtained in March, 1911, when 1,728,748 cubic yards of material, mostly rock, were excavated.

To handle this amount of material required the services of 115 locomotives and 2,000 cars, giving about 160 loaded trains per day to the dumps, which on the average were

View showing point of deepest excavation in Culebra cut, September 30th, 1912. Gold Hill on the right, where highest point of excavation will be 494 feet above the bottom. Contractors' Hill on the left, where highest point of excavation will be 364 feet above the bottom. The water standing in the lowest level is 6 feet above the bottom.

[illegible] distant, the haul one way varying, however, from about one mile to [illegible] miles. To serve properly the shovels and [illegible] employed in excavation work in the cut, although the latter is less than nine miles in length, about [illegible] miles of track are required, or an average of over nine parallel tracks at all points of the cut.

The deepest excavation is at Gold Hill, where the highest point of excavation is 494 feet above the bottom of the canal. At Contractor's Hill, a cut 364 feet in depth will be made in the face of the rock hill. The widest part of the cut is opposite the town of Culebra, where owing to the action of slides on both banks, the top width is now about half a mile.

In the earlier stages of the work, accidents resulting from the use of dynamite were unfortunately not uncommon, and one of the first steps taken was to require a strict inspection of the handling of dynamite and the loading and firing of holes. In spite of every precaution, it was found impossible to avoid a considerable number of miss-fires, and a study was made, with the assistance of the electrical and mechanical engineer, with a view of endeavoring to locate definitely the cause of these miss-fires.

As a result of a long series of experiments, it was conclusively shown that by far the greater number of miss-fires were due to the fact that the holes had been wired "in series." When the fuses were connected "in parallel" and fired by means of the ordinary electric light current, not a single failure of a fuse was noted in a test comprising several hundred fuses.

The results of this investigation were so convincing that all holes are now wired "in parallel" and miss-fires have been almost wholly eliminated, although it is scarcely necessary to state that accidents from individual carelessness, from flying stones, or from other causes, will always occur in the extensive use of dynamite, no matter what precautions may be adopted. It is, however, gratifying to state that although during the past three and one quarter years, in work under the writer's charge over 20,000,000 pounds of dynamite were used in blasting, but eight men have been killed, three of whom failed to go to a safe distance and were killed by flying stones, and two by miscounting the number of shots which had gone off in a "dobe" group, and approaching the group before the last shot had exploded.

Then, too, the character of the material to be blasted is of such a nature that slides and slips are of constant occurrence, rendering the use of explosives more hazardous than in ordinary localities. In addition, ever since the work of excavation has been commenced in the Culebra cut, areas have been uncovered where, owing to the presence of iron pyrites in finely divided form, the material on exposure to air generates, by oxidation, a sufficient degree of heat to fire dynamite when placed in the drill holes, and on two occasions dynamite has been so fired, but fortunately, without loss of life. As the heated layers may lie at any distance below the surface of the ground, and are usually rather limited in thickness, it is impossible from external observation to detect the heated holes by inspection, and in cases where danger from heating is apprehended, an iron pipe [illegible] inch in diameter is dropped into the hole and allowed to stay there about ten minutes. On being taken out and passed rapidly through the hand, it can readily and accurately be determined whether or not there is a heated layer of material in the hole, and if so, where it is located. On one occasion, a mass of heated material was encountered, which it was necessary to blast and remove with as little delay as practicable, and this was safely done by playing a stream of water from a hose into the holes during the entire process of loading and until the holes were fired.

The total amount of material excavated from the Culebra cut to date is as follows: By the French, prior to May, 1904, 20,419,720 cubic yards. By the United States, May, 1904, to October 1st, 1912, 85,370,236 cubic yards. Amount remaining to be excavated, October 1st, 1912, 9,250,000 cubic yards.

Parallel with the Culebra cut and on each side of it diversion ditches or canals were constructed in order to keep the waters from the drainage areas on the two sides of the cut from flowing into the latter and interfering seriously with or preventing excavation during the rainy season. The diversion ditch on the west side of the canal is known as the Camacho diversion, and is about 5½ miles in length, extending from Culebra to the Chagres River. This diversion has a capacity, at its mouth, of 3,000 cubic feet per second and was constructed by the French. On the east side of the cut, between Gold Hill and the Chagres River, for a distance of 5¼ miles, extends the Obispo diversion, which drains an area of nearly 10 square miles, having an average annual rainfall of about 83 inches, most of which occurs in eight months of the year. Its construction has cost up to date about $1,250,000—a large sum, yet without its protection, the canal could not have been completed. This diversion has been constructed since the United States assumed control. The third diversion, known as the Rio Grande diversion, extends from Rio Grande to Pedro Miguel, a distance of about three miles, and was constructed by the French. The large and annoying Cucaracha slide on the east side of the canal, between Gold Hill and Pedro Miguel, prevented the construction of a diversion along that portion of the Culebra cut.

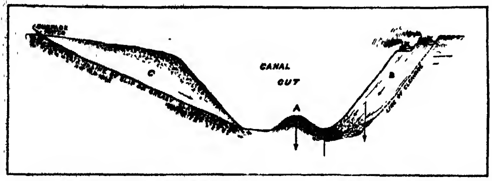


Diagram showing the action of slides in the Culebra cut. The mass C is moving into the cut by sliding; the mass B breaks on a line of cleavage and crushes the underlying material, forcing it up at A as shown. Note steam shovels taking off top weight from B.

The Problem of the Slides.

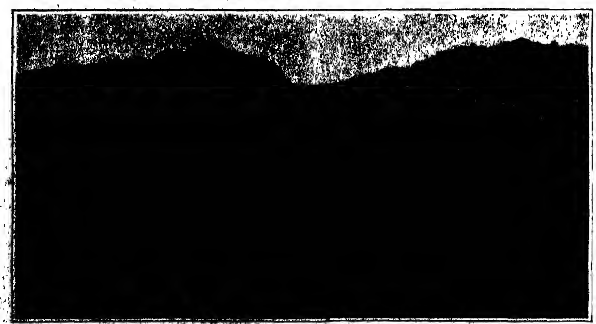
During the early stages of the work by the United States, there was but little movement of material into the canal from outside of the prism, and when such movement began, it was due almost entirely to slides caused by the slipping of the top layer of clay or earth upon a smooth sloping surface of some harder material, the layer of slipping clay in such cases varying in thickness from 10 to 40 feet.

The largest slide of this character is the Cucaracha slide on the east bank of the canal, just south of Gold Hill, which embraces a total area of over forty-seven acres. This slide extends up the bank for a distance of over 1,000 feet from the axis of the canal, and originally had a slope of about one vertical to seven horizontal. It first began to give serious trouble in the fall of 1907, and moved completely across the canal, the toe of the slide advancing for the first ten days at a uniform rate of about 14 feet in twenty-four hours. All tracks in its path were covered or destroyed by its resistless motion, and the moving material actually rose up on the west bank to a height of about 30 feet. Its movement was singularly like that of a glacier. It was, in fact, a tropical glacier—of mud instead of ice—and stakes aligned on its moving surface and checked every 24 hours by triangulation, showed a movement in every respect similar to stakes on moving glaciers in Alaska upon which the writer had made observations in 1896.

Up to July 1st, 1912, nearly 3,000,000 cubic yards had been removed from this slide, and it was estimated that about 230,000 cubic yards yet remained to be removed.

As the depth of the cut increased and the lateral support formerly afforded by the excavated material was removed, the great pressure of the superincumbent banks caused the crushing and squeezing out of under-lying layers of soft material, with a breaking, shearing and settling of the high banks and a corresponding elevation or "humping" of the bottom. (See diagram showing action of slides.) For the past two or three years, slides or breaks of this character have greatly exceeded those of the type represented by the Cucaracha slide. The largest slide of the type just described is on the west bank of the canal at Culebra, and covers an area of 75 acres. Up to October 1st, 1912, over 7,500,000 cubic yards of material had been removed from this slide and fully 2,000,000 cubic yards remained still to be removed. The

Slide in rock bank, side of cut north of Empire, which occurred August 20th, 1912. About 400,000 cubic yards of rocks slipped into the cut, destroying tracks, wrecking cars, and permitting the waters of the Obispo Diversion to flow into the cut.



Slide at Culebra on the [illegible] bank of canal, north of Culebra. About 1,000,000 cubic yards of material in motion moving toward the cut at the rate of three feet per day on a bottom slope of about one vertical to seven horizontal. June, 1912.

only remedy for slides of the first class has been to dig and haul away all of the material involved in the slide. With slides or breaks of the second class, a like course is pursued for banks already broken; but with slides of the latter class, preventive measures as well are taken. These preventive measures consist in flattening the slope of the bank where breaks might be expected by excavating and removing the upper portion of the banks by steam shovels, thus decreasing the pressure which might otherwise crush underlying layers of softer material and cause the bottom to heave up. This lightening of the superincumbent weight of the adjacent banks in the deeper portions of the cut by flattening the slope, has given results sufficiently encouraging to warrant the continuance of this work until all excavation has been completed and the full depth and width have been obtained.

With a few exceptions, the so-called slides during the past year were in reality breaks in the bank, resulting from the crushing of an underlying layer due to the great pressure of the high banks, the underlying layer being displaced laterally, and causing a heaving up of the bottom, amounting in one instance to as much as 30 feet.

On one occasion the writer was standing on a portion of the bottom of the cut, which rose six feet in about five minutes, and moved so smoothly and with so little jar as to make the movement scarcely appreciable, it being his impression at first that the steam shovel which he was observing was sinking and not that he was rising.

Innumerable plans for treating the slides have been suggested by interested and patriotic citizens throughout the country, but not one of them has proven practicable. The only successful method of treating the slides or breaks, once the material is in motion, is clouds of dust. One of these slides was moving on a surface which had a slope of one vertical to six horizontal, and its rate of advance was about 2½ feet per day for several months. A steam shovel made 168 cuts across the toe of this slide with the position of the loading track unchanged.

From the commencement of operations up to October 1st, 1912, there had been excavated and removed, about 18,000,000 cubic yards of material from slides, aggregating an area of about 220 acres, and there probably remain yet to be excavated on account of slides at least three or four million cubic yards more.

As the result of several years experience, slides and breaks are now handled with less inconvenience and interruption to other work than was the case in the earlier stages of operations. Yet, notwithstanding increased efficiency in handling them, they cause continual annoyance and interruption to work, and decrease the output and complicate the engineering problems; and while they present no insurmountable obstacles to the completion of the work in the Culebra cut, yet they are ever-present sources of annoyance, hindrance and expense. Their effects are especially felt in the destruction, displacement or covering up of tracks, requiring large track gangs to be kept continually at work in their vicinity.

A conservative estimate indicates that within the 8.8 miles of the Culebra cut, fully 200 miles of track have been destroyed, covered up or have had to be built, solely on account of slides; and in one locality for nearly two years tracks have had to be maintained on material moving at a rate varying from one or two inches to several feet per day, necessitating the constant presence of a track gang in order to permit the uninterrupted passage of trains.

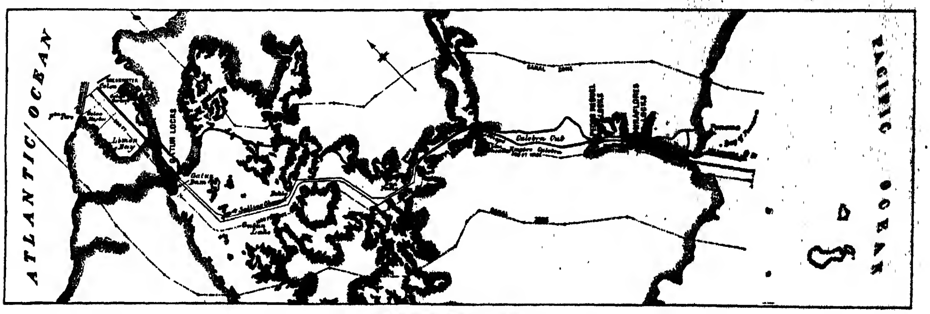
It will be seen from what precedes that when the

[illegible] work in the Central Division [illegible] completed with [illegible] material equivalent to the total [illegible] of slides having been removed [illegible] however, it would have been [illegible] have decreased the average monthly [illegible] to adding a large surplus of material.

The Greatest Engineering Work of All Time

IN conveying ideas of size and quantity to the mind there is a point at which the use of figures—becomes altogether inadequate. When statistics run into the millions, the mind, unless it is assisted by some more or less concrete scale of measurement, fails to form an adequate conception of what they mean. That this is particularly true of the great engineering work which is now drawing to a close on the Isthmus of Panama is proved at once by a glance at the pictorial representation on the adjoining page—a method of illustration with which our readers have been made familiar during the past few years in the columns of the SCIENTIFIC AMERICAN.

Alike in times ancient, medieval and modern, the great pyramid of Egypt (one of the "seven wonders" of the Ancient World) has been taken as the standard of measurement for engineering and architectural structures of exceptional proportions. Now, when the engineers of the canal tell us that the total amount of



Map of the Panama Canal.

to dig it out and haul it away until the slide comes to rest upon reaching the angle of repose for the particular material then in motion. This angle of repose varies much in different localities, depending upon the character of the material composing the slide, the angle of inclination of the strata and the angles of the numerous dikes, faults, seams, etc. At the Cucaracha slide, which has been practically at rest now for about a year and a half, the angle of repose corresponds to a slope a little steeper than one vertical to five horizontal, while on the west bank of the cut at the town of Culebra, the material is still moving slightly on a slope of about one vertical to five horizontal.

In one or two slides which have developed in the cut, the surface on which the material was sliding, had a slope of one vertical to ten horizontal, and in the case of another slide on the west bank of the canal, north of the village of Culebra, the moving material, which consisted of stratified rock, was moving *en masse*, at the rate of three feet in 24 hours, on a lignite layer about six inches thick, which had a slope of about one vertical to seven horizontal and was underlaid by layers of sedimentary rock, which did not move. A rather remarkable thing about this last slide was that, like two or three other slides, it developed in the dry season and moved at a faster rate during the four months when there was no rain than it has done since the rains have come.

The writer is aware that there is a very general impression that slides are due solely to saturation by rainfall, or underground water, of the material which is in motion, and while this is to a great extent correct for the slides like the one described at Cucaracha, yet there have been three large slides, involving in all nearly 2,000,000 cubic yards of material, which developed during the dry season and were composed wholly of material so dry that when loaded on the trains, the cars were almost hidden during the windy season by

Culebra cut shall have been completed, not less than 22 per cent of all material excavated by the United States will have been removed on account of slides, and that they will have added twenty-one or twenty-two million cubic yards to the amount of material to be excavated.

On the other hand, while their existence has increased the difficulties of the work and has added very considerably to the amount of excavation, and consequently to the cost, yet they have so far presented no obstacles which cannot be overcome without delaying the predicted date for the opening of the canal; nor will the additional material excavated on account of slides require any further appropriation in excess of the estimate submitted by the chairman and chief engineer on September 1st, 1908.

In this estimate, the "Division Cost" of all dry excavation remaining to be done in the Central Division after September 1st, 1908, was given as 75 cents per cubic yard, whereas the total cost of all excavation in the Central Division from September 1st, 1908, to September 1, 1912, was but $0.5184. The difference between the unit price submitted in the estimate and that at which the excavation was actually done between September 1st, 1908, and September 1st, 1912, amounts to a total of $17,013,6[illegible], the amount of excavation in question, having been 7[illegible] cubic yards—about three fourths being rock.

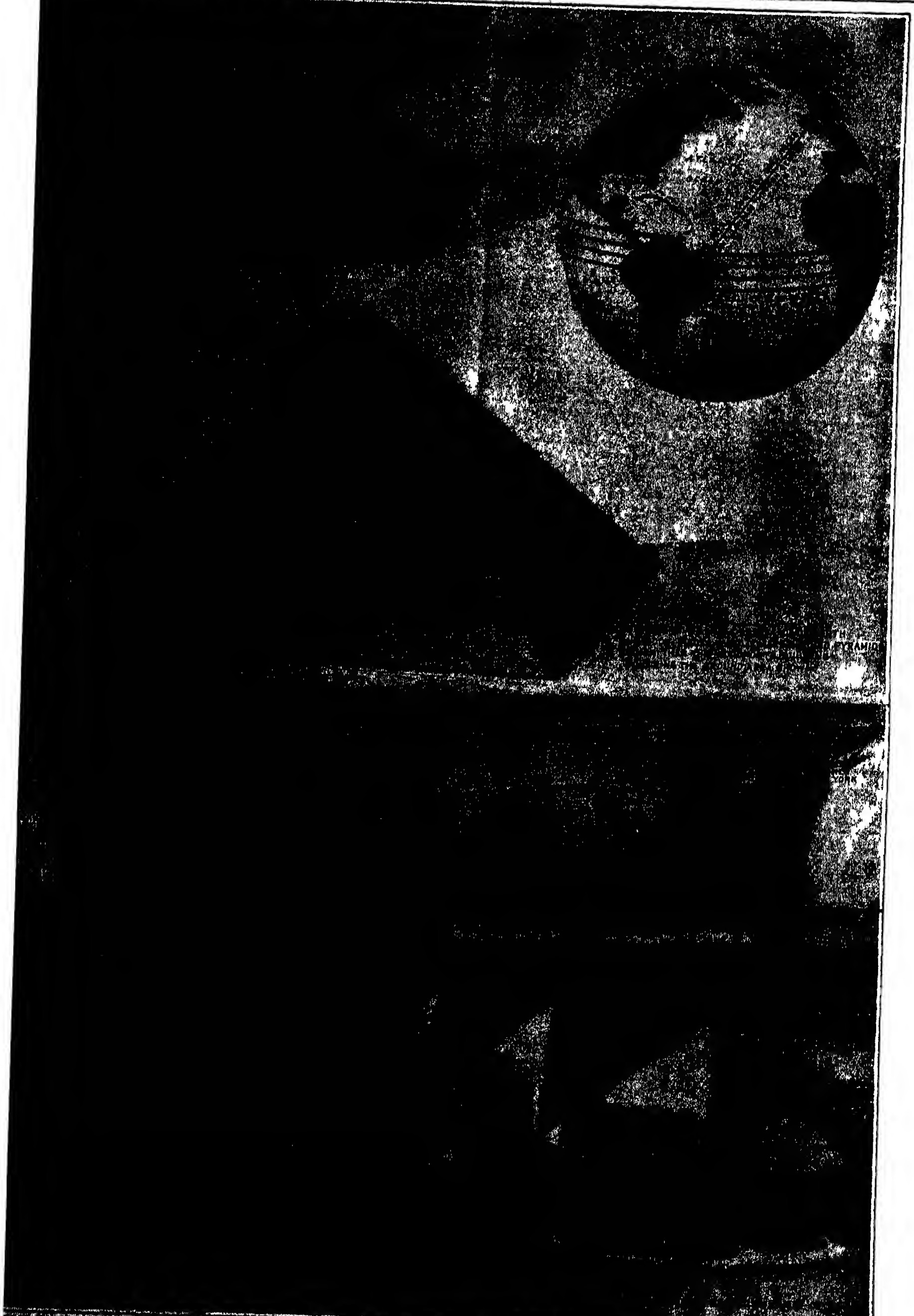
It must not be understood, however, that this total of over seventeen million dollars will be a clear saving, as fully seventeen to eighteen million cubic yards in addition to the estimate of September 1st, 1908, will have been added by the slides before work in the Central Division has been completed; and besides, a considerable amount of work not then contemplated has since been done. Yet, in spite of these large additions, aggregating probably nineteen or twenty million cubic yards to the quantity of material as submitted

excavation taken out of the completed canal will reach the great total of 212,227,000 yards, the average citizen understands, of course, that this represents an enormous mass of material. But when he is told that if the excavated earth and rock were dumped along the line of Broadway, New York, it would prove sufficient to form no less than sixty-three great pyramids, reaching for a distance of nine miles from the Battery to Harlem, there is little danger of his failing to appreciate the magnitude of the task of excavation at Panama.

Everybody knows that much trouble has been given along the line of the canal by slides of great magnitude. When we read that the total amount of extra material additional to the original estimate of excavation, which must be painfully shoveled onto the cars and hauled away out of the Culebra cut amounts to over 20,900,000 cubic yards of earth and rock, we apprehend but do not comprehend what this means. But when we are told that this material, if built into one huge mass, would make a pyramid of solid material reaching along Broadway from Chambers Street to Fulton Street and extending from the City Hall in City Hall Park to West Broadway, and that the apex of this pyramid would tower one hundred feet above the top of the Woolworth Building, we comprehend what a vast amount of additional work has been imposed upon the engineers by the unstable and treacherous character of the volcanic material through which the canal is being dug.

Also we know that the concrete work which has been done in building the locks at Gatun, [illegible] constitutes the [illegible] We understand, in a general way, that the four-and-a-half million cubic yards of concrete must represent a big bulk of material [illegible] locks and dams of the canal to [illegible]

(Concluded on page [illegible])



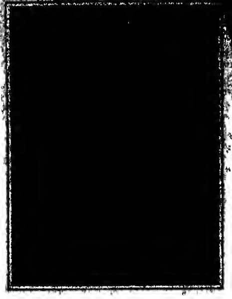
Pictorial representation of the enormous quantities of material handled in constructing the Panama Canal.

Barrel screened to keep out yellow-fever carrying mosquitoes.

The Sanitation of the Canal Zone

Teaching the Tropics How to Live

By Dr A J Orenstein, of the Department of Sanitation, Panama Canal



Spraying with oil to kill the mosquito larva.

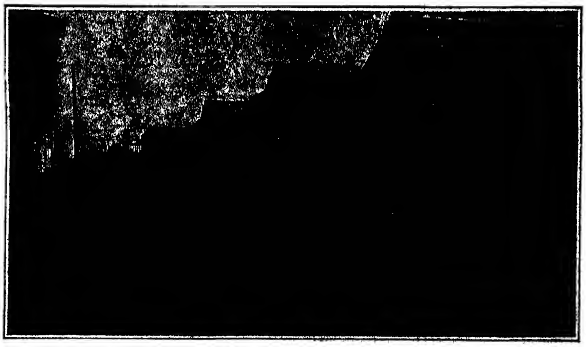
In 1905 a young physician received an appointment in the medical service of the Canal Zone He told the news to a professor in one of the leading colleges of the United States, a medical man of note a man who has served with great credit and ability in a difficult post as head of the Health Department of one of our largest cities This professor glanced at the letter of appointment and asked Are you going to accept the appointment? Yes I am going next Monday You are a fool, are you so tired of life that you want to commit suicide? And this gentleman s remarks were typical of what many well informed men would have said and with good reason at that time. Let us glance at the sanitary history of Panama For centuries the Isthmus of Panama was regarded as one of the worst plague spots of the world.

The Spanish occupation in the sixteenth seventeenth and eighteenth centuries was paid for with a fear ful toll to death The sturdy pioneer railroad builder Aspinwall carried forward to a successful conclusion the construc tion of the Panama Rail road a railroad forty eight miles long at a cost of life impossible to verify but to which the popular if fallacious legend gives a clue A life for each tie of the forty-eight miles

In January 1881 with pomp and circumstance with speech making and champagne with all the ceremonies so dear to the Gallic heart the great French engineer Ferdi nand de Lesseps fresh from his triumph in Suez inaugurated the work of building the Panama Canal De Lesseps little daughter turned the first spadeful of earth in the Panama Canal prism Al most simultaneously with this first excavation an other and grimmer kind of excavation commenced— the digging of graves for the thousands who laid down their lives because the great engineer who fought so successfully the shifting treacherous sands of Suez and who could have no doubt, conquered the many physical obsta cles in Panama did not recognize his most power ful antagonist in the hum ble little mosquito And so with the very first day of work on the canal the harvest of death and dis ease commenced Just how heavy it has been can only be surmised for the m rtality and morbidity statistics of the French were very incomplete.

Says Froude 'In all the world, there is not, perhaps, now concentrated in any single spot, so much swindling and villainy so much foul disease such a dung heap of moral and physical abomination as in the scene of this far famed undertaking of the nineteenth cen tury And to this veritable Hades of disease and death France sent her noblest and bravest sons who with Death grinning over their shoulders did work that is a monument to their engineering skill their ability and above all their courage. It took nerve to come to Panama then. It took an incredible amount of nerve to stay Every Frenchman who came to Panama knew that he was going to have yellow fever and that every second man taken with it would die The family of a French chief engineer consisted of five, four died of yellow fever Of the five members of the family of the superintendent of the railroad, three died of yellow fever Of twenty five Sisters of Charity who came to Ancon Hospital, twenty died of yel low fever And so, when we speak of the squandering of money by the French let us not forget that the "men on the job squandered but one thing—their lives. France failed to build the canal but she failed only because her chief enemy was unknown to her and, in her very failure France presented to the world an example of personal heroism and of engineering skill that she may point to with great pride.

When the United States Government undertook to build the Panama Canal it was recognized that the Canal Zone must be made habitable if the canal were to be built. Accordingly measures were undertaken to rid of yellow fever the two terminal cities—Colon on the Atlantic and Pana ma on the Pacific. Simul taneously a maritime quarantine service was es tablished to prevent the entry into the Canal Zone of communicable diseases. The theory of the rôle of the mosquito in the trans mission of yellow fever had been firmly estab lished by the work in Cuba The campaign against yellow fever was, therefore, inaugurated along the following lines (1) Isolation of yellow fever patients during the infectious period of the disease in such a manner as to prevent their being bitten by mosquitoes. This was accomplished by re moving all yellow fever patients to a screened room in the hospital (2) Fumigation of the houses where yellow fever cases were found, and the houses adjacent to these. This for the purpose of destroy ing the yellow fever in fected mosquitoes that might remain within the houses for the mosquito transmitting yellow fever, the Stegomyia (or *Aëdes*) calopus, does not fly far, but rather remains near the place where it bred out and had its blood meal. (3) Protection of dwell ings against mosquitoes by screening with wire gauze. (4) Destruction of all places favorable for the breeding of the Stegomyia calopus—the last task was a difficult one. The Ste gomyia calopus is a house mosquito. It breeds in water vessels near human habitation. Cisterns, wa ter pitchers, barrels, tin cans, etc. [illegible]



Colon—D Street, from Eleventh Street, looking north, December, 1908.

Colon—D Street, showing sewer and macadam road completed. July, 1911.

THE SANITATION OF THE ISTHMUS

[illegible] had public water supplies, the people [illegible] rain water and on water sold by vendors. [illegible] there were a number of water containers in which the Stegomyia bred in profusion. The [illegible] was to reduce to a minimum these water containers. Such vessels as were absolutely necessary for the storage of water were screened with wire gauze. The providing of Panama and Colon with modern water supplies was at once undertaken and pushed forward as rapidly as possible. With the introduction of modern water supplies the collection of water in cisterns, barrels, etc., could be discontinued and thus the breeding places of the Stegomyia were practically entirely destroyed. From having been the most numerous species of mosquitoes in Panama and Colon in 1905, the Stegomyia has now become the species least frequently encountered. A Stegomyia mosquito is now very hard to find, indeed. The results of this work were very soon manifested, as the following figures will show: From July 1st, 1904, to June 1st, 1905, 77 cases of yellow fever originated on the Isthmus. In June, 1905, 62 cases; in July, 42; in August, 27; in September, 6; in October, 8; in November, 2; December (in Colon), 1. During 1906 there was only one case of yellow fever on the Isthmus, in Colon. Since then not a single case of yellow fever occurred on the Isthmus, although a continuous influx of non-immunes is taking place.

With yellow fever under control, attention could be directed to the second enemy of the white man in the tropics—malaria, this disease is transmitted by certain members of the mosquito genus Anophelinæ. These mosquitoes differ greatly from the Stegomyia calopus in their breeding habits. While the Stegomyia calopus breed in water containers close to human habitations and do not fly very far, the Anophelinæ breed in streams, marshes, water holes, etc., and are capable of traveling considerable distances; probably as far as a mile and a half.

The campaign against malaria was inaugurated on the following plan: (1) Treatment with adequate doses of quinine (about 30 grains a day for adults) of all cases of malaria. First, because this treatment is curative; and, second, because, unless so treated, each case of malaria constitutes a focus from which malaria spreads. In malarial regions there are many persons who have what is often spoken of as chronic malaria. Such individuals frequently do not suffer any serious inconvenience. They more often suffer from occasional headaches, anemia or slight fever. These are the people most dangerous from the standpoint of the sanitarian. It is in the blood of these individuals that the malaria causing parasite has attained the form in which, if taken by a female Anopheline, it develops within this mosquito into the form capable of causing malaria in the individual whom the Anopheline may bite a week or so thereafter. (2) Protecting dwelling with copper wire gauze against the ingress of mosquitoes. All the houses occupied by Americans, and most of the others are screened. (3) Catching and killing mosquitoes within the dwellings. This is done by negro "mosquito-catchers," and is of great value in preventing malaria where other prophylactic measures cannot be inaugurated. (4) Destroying the breeding places of Anophelinæ by filling, draining, and training the banks of streams. (5) Destroying the Anophelinæ in the larval and pupal stages by oiling the water in which they are found; or applying a special larva poison to this water. (6) Clearing the rank vegetation in the immediate vicinity of dwellings and settlements, so as to destroy the shelter for such mosquitoes as may find their way to the vicinity of the houses; to hasten evaporation and the drying of small water collections and marshy places; to expose to view small breeding places and to remove the temptation to throw water containers into the vegetation.

These measures, conscientiously and painstakingly carried out, resulted in reducing the number of malaria cases treated in the hospitals from 0.83 per cent of the working force per month in 1906 to 1.53 per cent of the working force per month in 1911, and the death from malaria among employees from 233 in 1906 to 47 in 1911. In 1906 a good deal of preventive work had already been accomplished. What malaria would have done to the working force, had conditions remained as they were in 1904, is indicated by the fact that among 250 U. S. Marines stationed at Empire in the Canal Zone in 1904, 170 cases of malaria developed in four months.

In addition to the measures having an immediate relation to the prevention of disease, the steps taken to provide the employees at work on the Canal with comfortable quarters and wholesome food and recreation, have undoubtedly contributed greatly to the maintenance of good health. The history of pneumonia among the negroes illustrates this point. In 1906, before provision had been made to feed the laborers, and when housing had not been brought up to the present standard, a number of cases of pneumonia occurred among the negro laborers. The mortality from pneumonia was 413 in 1906 and 328 in 1907. A board appointed to study this disease recommended that the laborers be fed by the Government and that certain improvements in their housing be made. When these recommendations were carried into effect the number of cases of pneumonia immediately diminished. In 1908 there were but 93 deaths; in 1909, 70; in 1910, 73; in 1911, 94.

To carry out the preventive measures against malaria and yellow fever, the two principal enemies of the Caucasian in the tropics, as well as all the other sanitary work and treatment of the sick in the various hospitals, camps and in the homes, a force of about 1,400 is employed, of which about 750 are employed in the two terminal hospitals of Ancon and Colon, which cared for about 30,000 patients in 1911. The total appropriations for the whole Department of Sanitation for the eight years of its existence, has been about $12,900,000. Of this, however, only about one fourth, or about $380,000 a year, has been expended for sanitation, that is to say, for the prevention of disease. This $380,000 pays for the sanitation of about 100 square miles of territory with a population of about 90,000 or about one cent a day per person.

Pedro Miguel, showing mess hall and family quarters, screened against mosquitoes. 1911.

Toro Point, showing labor quarters with self-closing garbage cans. July, 1911.

Figures make dry reading, but indulge me in just one more statistical exposition. The malaria sick rate for 1906, if continued into 1911, would give on the basis of the number of employees in 1911, about 40,000 cases of malaria sick in the hospitals for the year, or a loss in labor of about 200,000 days of work. The total number of employees sick in hospitals with malaria in 1911 was 8,946—or a loss of 44,730 days of work. A gain of about 155,000 days was, therefore, made. Placing the loss to the Government for each day's labor, plus treatment, at the rather low figure of $3 per man, the gain in this one item of saving more than off-set the cost of sanitation proper. These figures do not include the malaria cases treated in the dispensaries and in homes. Among this class of patients the gain has undoubtedly been proportionate to the gain in hospital cases, and in addition it must not be forgotten that malaria is a disease that undermines a man's health insidiously and lowers his working efficiency to an extent not approached by any disease with the possible exception of hook-worm. The less malaria, the fewer inefficient workers in an organization.

The experience of the Panama Canal has demonstrated that proper sanitation, together with what may be called by the modern term of "social welfare work," such as providing proper housing, feeding, and amusements, can make possible residence, even prolonged

(Concluded on page 405.)

Pacific entrance. A typical concrete range-tower.

The Panama Canal and the Commerce of the United States

By Emory R. Johnson, Special Commissioner on Panama Traffic and Tolls

Atlantic [illegible]. The [illegible] [illegible] breakwater.

THE Panama Canal is being constructed to facilitate the commerce of the United States and of other countries, and to strengthen the efficiency and striking power of the American Navy. The great investment of capital has been made for the purpose of shortening ocean routes, first of all to enable the commerce between the Atlantic and Pacific to be handled more economically, and second, to add to the military power and prestige of the United States.

The economy due to the shortening of ocean routes is measured by the saving in time vessels take to carry freight and passengers from one port to another. The shorter ocean route is ordinarily more economical than the longer one, although it may happen that the circuitous route between the vessel's port of departure and port of destination may be taken, because of greater opportunities for trading on the way, and because of differences in fuel expenses by the alternative routes. To measure the advantages of the Panama Canal to the trade of the United States and other countries, it is necessary, both to consider the effect of the canal upon the length of ocean routes and to take account of relative fuel expenses by the canal and other routes.

The trade between the two seaboards of the United States will derive maximum benefit from the canal. The distance from New York to San Francisco by way of the Straits of Magellan is 13,135 nautical miles, by way of Panama 5,262 miles, the canal route being 7,873 miles shorter. Between New Orleans and San Francisco, the saving in distance is still greater—8,868 nautical miles. The shortest ocean route now used for trade between the two seaboards is the one by way of the Isthmus of Tehuantepec, across which freight is transferred from ship to ship by the Mexican National Railway. The distance from New York to San Francisco via Tehuantepec is 1,016 nautical miles, and from New Orleans to San Francisco, 1,573 miles less than by way of Panama. These differences in distance, however, will not enable the Tehuantepec route to compete with the Panama Canal.

The freight rates of the American-Hawaiian Steamship Company between our two seaboards are said to average about $10.50 per ton and one third of this through rate is paid to the Mexican National Railway for the transfer of cargo from ship to ship. This charge is doubtless profitable to the Mexican National Railway, but it is probable that the cost of getting cargo from ocean to ocean at Tehuantepec could not be brought below $2.50 per weight ton, and it is probable that even with reasonable tolls at Panama the cost of taking traffic from New York to San Francisco by way of Tehuantepec will be $2 per cargo ton greater than the expense of taking the traffic by way of a Panama Canal. The double handling of commodities at the Isthmus of Tehuantepec with the unavoidable breakage and damage incident thereto, together with the greater cost of handling traffic by that route, make certain the impossibility of successful competition of the Tehuantepec route with that via Panama.

The aid given by the Panama Canal to the commerce between the Atlantic-Gulf Seaboard of the United States and the west coast of South America will be the second most important influence of the canal upon commerce as shown in Table I. In computing the time saved, one half day is allowed for the passage through the canal.

The South American ports selected are located in the northern, central and southern sections of western South America, and the reductions in time given in the table are for vessels of 9, 10 and 12 knots speed—the rate at which most freight vessels are now operated—and for vessels of 14 and 16 knots speed, which represents the rate of passenger steamers over practically all routes, except those across the North Atlantic. Callao, which is the chief port of Peru, is 1,346 miles from Panama and 2,666 miles from the Straits of Magellan, while Valparaiso, the principal port of the agricultural portion of Chile, is 1,433 miles from Panama and 2,616 miles from the Straits of Magellan. The saving in distance and time between the Atlantic Gulf ports of the United States and the west coast of South America is so great that the canal will be used by all the commerce, even though the price of fuel by the canal and the Straits of Magellan routes were the same. As a matter of fact, however, fuel expenses by way of the Straits of Magellan will be much heavier and the amount of space which vessels will have to devote to the transportation of fuel, instead of cargo, will be much larger.

TABLE I.—DISTANCES AND TIME SAVED VIA THE PANAMA CANAL AS COMPARED WITH THE STRAITS OF MAGELLAN BETWEEN THE ATLANTIC-GULF PORTS OF THE UNITED STATES AND THE WEST COAST OF SOUTH AMERICA.

To	From New York.						From New Orleans.					
	Distance saved.	Days saved for vessels of					Distance saved.	Days saved for vessels of				
		9 knots.	10 knots.	12 knots.	14 knots.	16 knots.		9 knots.	10 knots.	12 knots.	14 knots.	16 knots.
	Miles.						Miles.					
Callao	6,250	28.4	25.2	21.9	[illegible]	15.7	7,345	33.9	30.7	25.7	21.1	[illegible]
Iquique	5,189	23.3	20.9	17.3	14.9	12.9	6,184	27.9	25.0	20.9	17.7	15.4
Valparaiso	3,747	16.8	15.1	12.5	10.8	9.3	4,742	21.4	19.2	16.0	13.6	11.8
Coronel	3,266	14.7	13.2	10.9	[illegible]	8.1	4,391	19.4	17.4	14.4	12.3	10.7

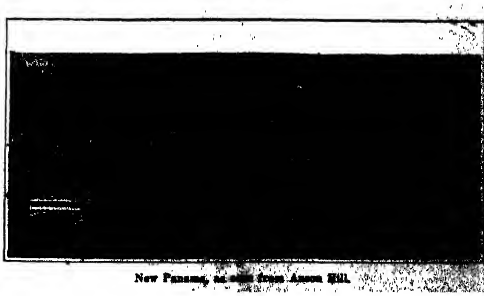
The effect of the Panama Canal upon the trade of the United States with New Zealand and Australia promises to be of great commercial benefit to the United States. The commerce of the eastern seaboard of the United States with Australia and New Zealand in 1910 was valued at $48,548,000, the increase during the preceding decade having been 68 per cent. Australia has a very large commerce amounting to $130 per capita, while New Zealand's trade averages $170 per inhabitant. The foreign commerce of New Zealand per capita is five times that of the United States. The saving in distance and time of voyages for vessels of 9 to 16 knots speed is stated in Table II.

The distance from New York and Adelaide via the Panama Canal will be 1,146 miles less than via the Cape of Good Hope. To Melbourne, the reduction in distance will be 2,770 miles and to Sydney 3,852 miles. For the voyage between New York and Sydney vessels of 10 knots speed can save 15.8 days. A calculation has been made of the fuel expenses of a 10½-knot freight steamer whose average daily coal consumption at sea is 38 tons. This vessel would save about $3,890 in coal expenses by taking the Panama route instead of one around the Cape of Good Hope, on a round-trip voyage between New York and Adelaide. For a round-trip voyage between New York and Sydney the fuel expenses via Panama would be about $6,230 less than by way of the Cape of Good Hope. In making this and other calculations referred to in this paper, the 1912 contract prices for coal were taken. It was assumed that the price of coal at Colon or Cristobal would be $5 per ton and at Balboa $5.50 per ton. These prices are about $1 above the cost of coal delivered at the end of ship's tackle on the Isthmus of Panama at the present time. Under present contracts, the United States Government is securing 500,000 tons of coal per annum, delivered at the end of ship's tackle at Cristobal for $4.09¼ per ton. It was believed in making the coal calculations above referred to that somewhat less than $1 per ton would amply defray overhead expenses, depreciation of fuel, and lighterage charges, and that the United States Government could, without loss, sell coal, delivered in ship's bunkers, at Cristobal for $5 per ton. The 1912 contract prices for Welsh coal at Port Said, Suez Canal, it may be mentioned in passing, are from $6.20 to $6.32.

Ruins of old Panama which was burned by the buccaneer Morgan.

For the trade between the Atlantic-Gulf Seaboard of the United States and Oriental countries east of Singapore, the Panama and Suez canals will be competitors. The distance from New York to Hongkong and Manila is about the same via the Panama and Suez routes. For points north and east of Hongkong, the Panama route will be shorter; for places south and west, the distance will be less via Suez, as shown by Table III.

If the tolls at [illegible] are [illegible] higher than those at [illegible] the two routes will be put [illegible] competitive basis [illegible] charges are concerned [illegible] choice of routes taken by [illegible] between our Atlantic Seaboard and the Orient east of [illegible]



New Panama, as seen from Ancon Hill.

[illegible] the prospects [illegible] coaling facili- [illegible] the Panama [illegible] Suez route for [illegible] of the United [illegible] is for the [illegible] moderate cost [illegible] between the [illegible] and the Pa- [illegible] in advance with [illegible] will doubtless be much [illegible] in the Orient. Some vessels will [illegible] ports for New York by way of the [illegible] Canal and Europe, and it is also to be expected that vessels will leave Singapore for New York via Chinese and Japanese ports and the Panama Canal. All things considered, it seems probable that the Panama Canal will be used by most of the traffic handled between the Atlantic-Gulf Seaboard of the United States and the Philippines, Hongkong, and points north and east thereof.

The tonnage of shipping that might have used a Panama Canal in 1899 was carefully investigated and a similar study was made of available canal tonnage for the statistical year 1909-10. It was found, in 1899, that a Panama Canal would then have been used by about 5,000,000 net tons of shipping. The shipping that would have used the canal during the year 1909-10 amounted to 8,328,000 net tons. The increase during the eleven years was 66⅔ per cent, or at the rate of 60 per cent per decade. Table IV summarizes the results of the investigation of the traffic available for the use of the canal in 1909-10.

The details summarised in the Table IV indicate that the commerce between the two seaboards of the United States during the statistical year 1910 amounted to only about 10½ per cent of the total available canal traffic. The trade of the United States with foreign countries included 83 per cent of the total canal traffic, while the commerce of Europe with the west coast of South America amounted to 38 per cent of the total.

TABLE IV.—NET TONNAGE OF VESSELS THAT MIGHT HAVE ADVANTAGEOUSLY USED A PANAMA CANAL IN 1909-10.

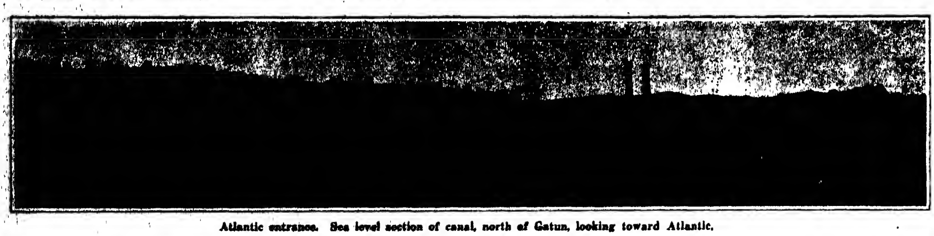
	Total Entrances.	Total Clearances.	Total Entrances and Clearances.
Europe with:			
Western South America...	1,553,887	1,594,513	3,148,400
Western Central America and Pacific Mexico....	80,788	118,714	199,502
Pacific United States, British Columbia, and Hawaii	419,865	269,853	689,718
Pacific United States via Suez Canal..........	(1)	(1)	(1) 158,000
Oriental countries east of Singapore and Oceania..	618,704	555,881	1,174,585
Eastern United States coast with:			
Western South America, Pacific Mexico, and Hawaii	300,909	166,686	467,595
Pacific Coast of United States (via Cape Horn)	117,147	55,508	172,655
Pacific Coast of United States and Hawaii (via American-Hawaiian S.S Co.)............	181,713	181,713	363,426
Oriental countries east of Singapore and Oceania.	600,000	900,000	1,500,000
Pacific traffic:			
Pacific Coast, ...	158,558	259,932	418,490
Atlantic Coast..........	....	....	....
Eastern Canada with Alaska, Chile and Australia......	13,410	22,248	35,658
Total........	4,044,981	4,125,048	8,328,029

NOTE.—(1) Reported by Suez Canal Company, hence the total is not separable into entrances and clearances at American ports.

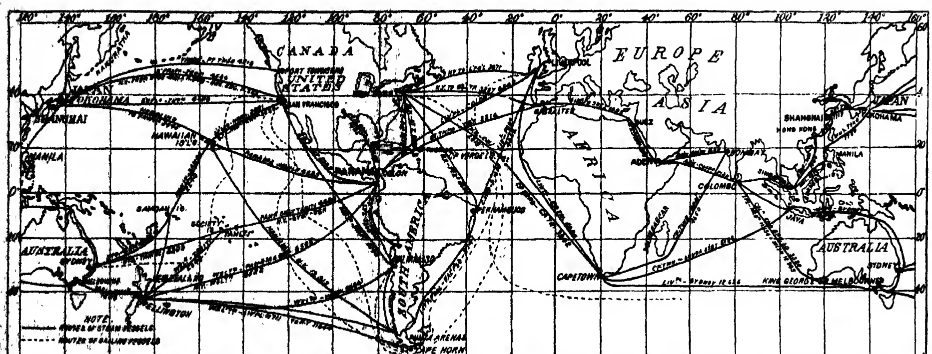
In order to estimate conservatively the probable tonnage of traffic that will use the Panama Canal during the early years of its operation, a study was made of the growth of traffic at the Suez and of the increase of the commerce of the world as a whole, and of different sections of the world. The traffic of the Suez Canal increased 70.26 per cent during the decade ending in 1910. The value of the trade of the United States with non-European countries advanced 67½ per cent that decade. These and other percentages of commercial increase make it apparent that an increase of 60 per cent per decade in the shipping using the Panama Canal may be conservatively assumed. At the present rate of increase the commerce available for the Panama Canal during the first year or two of its operation will amount to about 10,500,000 net tons of shipping per annum. Naturally the canal will stimulate the growth of commerce, but if it be assumed that the rate of increase in the canal traffic during the first decade is only equal to the rate at which its available traffic is now growing, the net tonnage of ships using the canal by 1925, at the end of the first decade of the canal's operation, will amount to about 17,000,000 tons per annum. By the end of the second decade the tonnage may be expected to have reached 27,000,000 tons.

The canal will unquestionably largely increase the tonnage of waterborne traffic between the two seaboards of the United States. The brief table Number V classifies the estimated net tonnage of shipping that will use the canal in 1915, 1920 and 1925

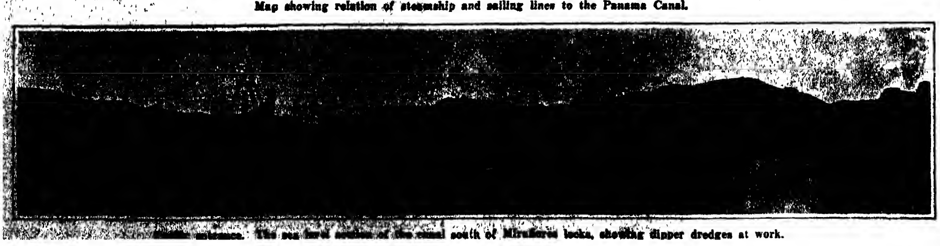
In the table the tonnage credited to the coast-to-coast American shipping in 1915 was obtained by assuming that the tonnage of traffic handled by water between the two seaboards in 1910 will increase at the average rate at which the total traffic of the canal is growing. Probably it will increase more rapidly than this. It is believed that our intercoastal shipping through the canal will double during the decade ending in 1925. At that rate of growth, the coast-to-coast shipping through the canal will amount to 1,414,000 tons in 1920.



Atlantic entrance. Sea level section of canal, north of Gatun, looking toward Atlantic.



Map showing relation of steamship and sailing lines to the Panama Canal.



[illegible] entrance. The sea level section of the canal south of Miraflores locks, showing dipper dredges at work.

TABLE II.—DISTANCES AND TIME SAVED VIA THE PANAMA CANAL AS CONTRASTED WITH ROUTES VIA THE SUEZ CANAL, THE CAPE OF GOOD HOPE, AND THE STRAITS OF MAGELLAN BETWEEN THE ATLANTIC-GULF SEABOARD OF THE UNITED STATES AND AUSTRALASIA.

To	From New York. Distance saved.	Days saved for vessels of 9 knots.	10 knots.	12 knots.	14 knots.	16 knots.	From New Orleans. Distance saved.	Days saved for vessels of 9 knots.	10 knots.	12 knots.	14 knots.	16 knots.	Remarks.
	Miles						Miles.						
Adelaide	1,746	7.5	6.7	5.6	4.6	4.0	3,266	14.6	13.1	10.8	9.2	8.0	Difference between routes via Panama, [illegible] and Melbourne, and via St. Vincent and Cape of Good Hope.
Melbourne	2,770	12.3	11.0	9.1	7.7	6.7	4,383	19.3	17.3	14.3	12.2	10.7	Difference between routes via Panama, [illegible] and via St. Vincent, Cape of Good Hope, [illegible].
Sydney	3,932	17.7	15.8	13.1	11.2	9.7	5,444	24.6	22.2	18.4	15.7	13.7	Difference between routes via Panama [illegible] and via St. Vincent, Cape of Good Hope, Adelaide [illegible].
Wellington	2,493	11.0	9.9	8.1	6.9	6.0	3,486	15.6	14.0	11.6	9.9	8.6	Difference between routes via Panama and Tahiti and via Straits of Magellan.

TABLE III.—DISTANCES AND DAYS SAVED BY THE PANAMA OR THE SUEZ CANAL BETWEEN THE ATLANTIC-GULF SEABOARD OF THE UNITED STATES AND JAPAN CHINA, THE PHILIPPINES, AND SINGAPORE.

To	Via	From New York. Distance saved.	Days saved for vessels of 9 knots.	10 knots.	12 knots.	14 knots.	16 knots.	From New Orleans. Distance saved.	Days saved for vessels of 9 knots.	10 knots.	12 knots.	14 knots.	16 knots.	Remarks.
		Miles.						Miles.						
Yokohama	Panama	3,768	16.9	15.2	12.6	10.7	9.3	5,735	25.9	22.3	19.2	16.5	14.4	Via San Francisco.
	Suez													Via Colombo, Singapore, Hongkong and Shanghai.
Shanghai	Panama	1,876	8.1	7.3	6.0	5.1	4.4	3,813	17.1	15.4	12.7	10.8	9.4	Via San Francisco and Yokohama.
	Suez													Via Colombo, Singapore and Hongkong.
Hongkong	Panama							1,919	8.4	7.5	6.2	5.2	4.5	Via San Francisco, Yokohama and Shanghai.
	Suez	18												Via Colombo and Singapore.
Manila	Panama	41						1,978	8.6	7.7	6.4	5.4	4.7	Via San Francisco and Yokohama.
	Suez													Via Colombo and Singapore.
Singapore	Panama													Via San Francisco and Yokohama.
	Suez	2,484	11.0	9.8	8.4	6.9	5.9	547	2.0	1.7	1.4	1.1	0.9	Via Colombo.

TABLE V.—CLASSIFICATION OF ESTIMATED NET TONNAGE OF SHIPPING USING THE PANAMA CANAL IN 1915, 1920 AND 1925

	Average per annum during 1915 and 1916.	1920	1925
Coast-to-coast American shipping	1,000,000	1,414,000	2,000,000
American shipping carrying foreign commerce of the United States	720,000	910,000	1,500,000
Foreign shipping carrying commerce of the United States and foreign countries	8,780,000	11,020,000	13,850,000
Total	10,500,000	13,344,000	17,000,000

The foregoing details regarding the effect of the Panama Canal upon the length and time of ocean voyages, and the figures presented regarding the traffic of the Panama Canal, show conclusively that the new route between the Atlantic and Pacific will be of great commercial usefulness. Its effect upon the industries and trade of the United States will be large and far-reaching.

Color Photography of the Moon

IN a recent number of the *Astrophysical Journal* Prof. Wood discloses the possibilities of photographing celestial objects by using the visual region of the spectrum alone, the violet region alone, and the ultra-violet region alone. The photographs of the lunar surface taken by Prof. Wood by these three different methods show very marked differences of brightness. A patch just above the crater Aristarchus is as bright as the surrounding surface when the "visual" region is employed, comes out rather darker on the "violet" image, and is quite dark when photographed in the "ultra-violet" light. Some of the *maria* appear darker in the violet picture and appear to be differentiated *inter se* by the selective process. Prof. Wood suggests that, were it possible to take pictures over a great range of different wave-lengths, it would become possible to take up the subject of lunar petrography. A series of experiments led him to the conclusion that the dark patch near Aristarchus is covered by a form of sulphur *or some sulphur compound.* If it were possible to extend the range of photographs to where the silicates begin to show, by anomalies in reflecting power, one might be able to map out the lunar surface petrographically.

Schaumasse's Comet

A CABLEGRAM received at Harvard Observatory from Kiel gives the following elements and ephemeris of Schaumasse's Comet, computed by Schaumasse and Fayet, of Nice, from observations on October 18th, 19th, and 20th:

ELEMENTS.

Time of perihelion passage	(T)	Oct. 25.81 G.M.T.
Perihelion minus node	(ω)	269° 26′
Longitude of node	(Ω)	270° 24′
Inclination	(i)	58° 58′
Perihelion distance	(q)	1.051

EPHEMERIS.

G.M.T.		R.A. h.	m.	s.	Dec. °	′	Light.
October	26.5	10	19	33	—7	51	1.00
	30.5	10	30	57	—12	41	
November	3.5	10	42	37	—17	25	
	7.5	10	54	30	—22	02	0.87

Correspondence

[*The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.*]

The Broken Rail Question

To the Editor of the SCIENTIFIC AMERICAN:

I am following the broken rail question. Your splendid editorial, "The Steel Rail," so far as describing the stresses to which it is subjected is concerned, is complete except the main stress, the "Punch of the Piston," and I have to disagree with the remedy you suggest, better quality, because the heavy traffic demands a very hard rail in order to be durable, and it is this durability feature that renders the rail brittle. Consequently, I am providing a remedy by taking the "punch" out of the locomotive. Mr. C. E. Fisher's letter, "The Rail Question," in which he recounts that an engine in the Middle West broke 150 rails on one trip, proves my argument. What he means by the cause, "not properly balanced," is not understood, because the "punch" is truly alternate, in fact, this is the principal element in creating the "punch"—the rocking motion imparted by the down stroke of the piston alternately on opposite sides. And that two hundred broken rails were removed from a one hundred mile section after one night's traffic would seem to prove that defects were not the sole cause.

St. Louis, Mo. GEORGE J. FERGUSON.

Determinism in Science

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 31st a correspondent who signs himself C. H. K. attacks my statement as to Determinism being the truly scientific standpoint, and advances the argument of common experience in favor of the Free-will theory. I disagree with this to the extent of maintaining that all experience, on the contrary, points to the truth of the deterministic doctrine. All our systems of education, intellectual and ethical, as well as all our social activities, are based on the assumption that human conduct is determined by influences acting upon the will, and that it is possible to a great extent to foresee and to bring about certain lines of conduct as the results of certain causes. According to the Free-will theory, however, we are angry, despondent, foolish, vicious, or whatever, simply because we choose to be so. I cannot think that human nature is so base. I believe that if the will were free we should all be sages or saints.

Your correspondent closes his letter with a query as to which is the more scientific, Free-will or Determinism. Determinism is scientific, Free-will is not. Determinism is simply the universal application of the law of cause and effect. Every phenomenon, psychical as well as physical, arises from a cause—really a complexity of causes—which in turn results from preceding causes, and so on back to infinity. Free-will assumes that psychical phenomena transcend this law of cause and effect, and admits the unthinkable doctrine of chance.

Determinism is not a "lazy man's doctrine," as I have heard it called. It soothes the pangs of defeat it is true; but unto him who has come to realize how ceaseless and deep is the influence of each of us upon the lives of those around him, Determinism acts as a most powerful stimulus to wise and unselfish conduct.

Washington, D. C. PAUL R. BIRGE.

Gyroscopic Action of Revolving Aeroplane Motors

To the Editor of the SCIENTIFIC AMERICAN:

An answer to Mr. Brooks's indictment of the revolving-cylinder motor which appeared in your issue of September 28th, 1912, can be found in the SCIENTIFIC AMERICAN of September 14th, 1912, where on page 231, in the description of a visit to the Gnome motor factory, Mr. Seguin, during the actual tests for gyroscopic action, concludes by saying: "Of course, it exists, but I account for the fact that it is negligible in actual practice in that the plane of rotation of the motor is not changed rapidly enough to produce a noticeable gyroscopic effect."

I asked the late Paul Peck some months ago whether he was troubled by this force, when he replied that he noticed it in the beginning, but after he had gotten used to the motor he found that it rather added stability to the aeroplane flights and that he then forgot all about it.

This is evidently the experience in France, where, I am sure, not less than three fourths of all army aeroplanes are fitted with revolving-cylinder motors; and we hear very little of accidents from that country.

Paul Peck came to his early death because he had the fatal tendency to steep dipping, against which risky habit he had often been warned by a number of people; to lay the blame for the accident to the gyroscopic action of the motor as such is therefore unfair and unscientific.

Even if the gyroscopic force enhanced the danger of steep dipping, which it probably does, it would merely emphasize the folly of this entirely unnecessary and foolhardy practice, and would not diminish the value of light and air-cooled revolving-cylinder motors in the development of the flying art. EMILE BERLINER,

PRESIDENT THE GYRO MOTOR COMPANY.

Washington, D. C.

The Refractory Collar Button

To the Editor of the SCIENTIFIC AMERICAN:

W. A. B. in your issue of August 24th, 1912, advises us to use paraffine on the back of a button-hole to facilitate the passage of a collar button.

As paraffine is not always conveniently near, I suggest something that we always have with us.

Hold the part of a collar or cuff containing the button-hole between the tongue and the roof of the mouth about three seconds, and the starch will soften, rendering the button-hole so pliable that the most obstinate button will easily pass through.

Columbus, O. [illegible]

Type of motor to be used in operating canal.

The Electrification of the Panama Canal

By David B. Rushmore, Member American Institute Electrical Engineers

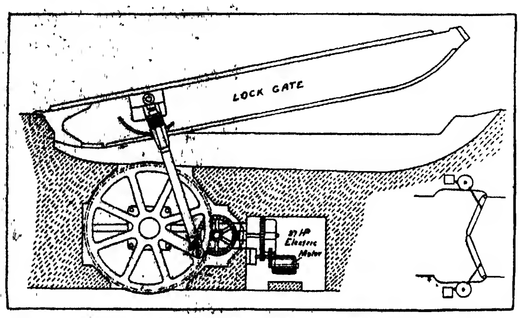
Steam-electric power station at Miraflores.

THE work of digging the Panama Canal has a history of its own. As the operations passed from one company to another, and as man succeeded man in charge of this work, the plans underwent constant modification, and methods of accomplishing such work have passed through a very great evolution. Working side by side on the Isthmus have been machines belonging to different decades of historical development. In the work of construction electricity has unfortunately filled a minor part. Due to the pressure at the time the United States Government took control and the necessity for immediate results, it was impossible to develop the water power on the Chagres River as was planned, and to use electric power for a large part of the work. Also, civil engineers have not utilized electrical machinery to the extent which they will in the future, and the small self-contained steam units were applied much more quickly than could have been done with electricity, even though the final cost for the present methods must necessarily be higher. When we come to the operation of the Panama Canal, however, the situation is entirely changed. Here the present management has had a free hand and electricity will be used throughout all the operation of the machines and appliances incidental to the use of the canal.

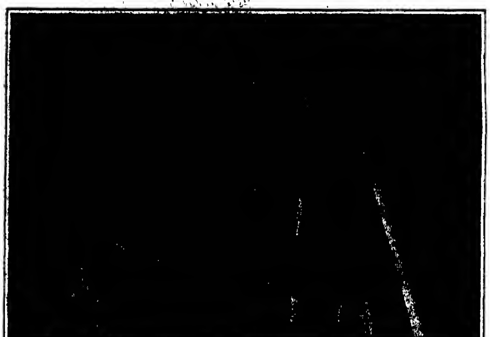
The principal application will be that of 985 motors of 34,300 total horsepower for the operation of the lock gates, fender chains, pumps, etc. Ships will be towed through the locks by powerful electric locomotives, and a large miscellaneous application of electric power will be found in the machine shops, the dry docks, coal handling plant, wharf cranes, and it will be used for many other purposes. Electric lighting will be used wherever possible in connection with the canal and nearby towns in the zone, and the relocated Panama Railroad will possibly be electrified in the near future.

The power will be generated in two large stations, and over one thousand motors will be used for the operation of the canal. Two steam-electric stations now exist at Gatun and Miraflores, each consisting of three 1,500 KVA, 3-phase, 25-cycle, 2,200-volt, steam turbo-driven generators; two 25 Kw., 125-volt turbo-driven exciters with the necessary switchboards, rotary converters, etc. The power station at Miraflores will be retained and power will also be developed from a hydro-electric station in connection with the Gatun dam.

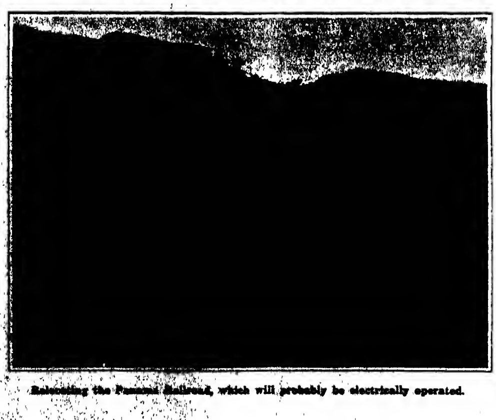
The [illegible] square miles of storage in Gatun Lake makes possible the development of the hydro-electric station, in which not over [illegible] per cent of the minimum water supply will ever be used. In the rainy season, water, of course, will be so plentiful that it will be wasted over the spillway. This hydraulic plant will consist of three 2,500 KVA, 3-phase, 25-cycle, 250 revolutions per minute, 2,200-volt, waterwheel-driven, exciters with provisions for three additional units.



Plan view of mechanism for opening and closing gates.



Completed gate-closing gear, showing 27 horse-power motor, gear, and 5-ton arm.



Relocating the Panama Railroad, which will probably be electrically operated.

Protection against severe strains of short circuits will be obtained by the use of external reactances, consisting of air insulated coils mounted on concrete cores. The 50 kilowatt exciters will be mounted on the vertical shaft below the rotating field and above the waterwheel. In addition, there will be two 100 kilowatt induction motor-driven exciters taking power from the main 2,200-volt buses. Remote control will be used throughout and the operator will be located near the switchboard on the second gallery, from which the entire station may be seen.

Two hundred and twenty-volt motors will be used for operating the locks, and transformers located at various sub-stations will be used to step down from the 2,200-volt power of the generating station. The transformers will be located in rooms, each of which will be practically a self-contained sub-station. The Gatun locks will have sixteen such rooms. There will be eight for Miraflores, and Pedro Miguel will require twelve. Every transformer station will have duplicate transformers, of 200 KVA capacity, feeders and buses to provide for a continuous service in case of emergency conditions. Under the usual conditions of operation one transformer will be connected to the locomotive track and the other to the machinery motors. Should either feeder or transformer break down a quick transfer to the reserve unit can be made. In each room there will also be installed a single-phase lighting transformer of 25 kilowatt capacity, and there will be distributed throughout the locks approximately 7,000 lamps. Oil switches of special "foolproof" design, automatic relays, panels, etc., constitute the control equipments; the design of which has been carried out with extreme care to provide for maximum reliability and flexibility of operation, together with the greatest safety for the operators, which latter is of unusual importance in connection with the climatic conditions of the Canal Zone.

Altogether over 1,000 individual motors will be required for the different locks. The most powerful electric motors ever designed for commercial service known are the mill-type motors, which are used for the rough service of steel mills. It is these motors which will be used for the gates, valves, cranes, emergency dams, etc., and they will all be fitted with solenoid brakes. The load curves of these show an extremely intermittent service, and they vary to a considerable extent with the different applications. Apparatus which has been in idleness

(Concluded on page 405.)

The House Fly's Deadly Scourge

PICTURED in the accompanying photograph is a house fly which has been destroyed by the parasitic fungus known as *Empusa muscæ*. This fungus is a deadly enemy of the house fly, and it must destroy myriads of these pernicious insects, especially in the fall. The flies may often be seen in a dead or dying condition on walls, ceilings and window-panes, surrounded by a quantity of white powder, i. e., the spores of the fungus which have fallen from the insect's body. These spores are capable of infecting other flies which may come in contact with them. Whether the flies actually eat the spores, or merely get them attached to their bodies, is not apparently known.

The Bezoar and Its Imaginary Virtues

IN accordance with the ancient idea of ascribing to everything of mysterious or obscure origin, occult, often marvelous properties, the bezoar, not infrequently found in the stomachs of herbivorous and ruminant quadrupeds, goats and antelopes particularly, has been credited with qualities that imparted to it a great value among credulous and semi-civilized peoples, especially in ancient times.

Having as a rule, for its nucleus, some indigestible substance, taken into the stomach with the food, as a measure of protection and to render it harmless, it was gradually coated with a concretion of mineral substance, just as the oyster, coating an intrusive particle with nacreous matter produces the much admired and costly pearl. Sometimes the coating consists of superphosphate of lime and sometimes of phosphate of ammonia or magnesia.

In many instances, the hair carried into the stomach in the course of the licking process by means of which these animals cleanse their coat, would be incorporated with the mineral deposit and felted into a mass of great solidity, the bulk being at the same time greatly increased, so that these accumulations often reached a diameter of several inches. In the stomachs of slaughtered beeves such masses are quite common.

These, however, were not the bezoars that were esteemed for their remedial or protective properties. The latter were compact concretions of mineral matter sometimes radial in structure, sometimes composed of concentric layers and of stone-like hardness. They are classed as Occidental, Oriental and German. It was in the Orient—the land of mystery—that the bezoar enjoyed the widest esteem for its supposed medicinal virtues. The possession of such a concretion was believed to insure the protection of the owner against various diseases, they were also regarded as especially efficacious as an antidote to poisons and even against the bites of the venomous reptiles with which tropical Asia abounds.

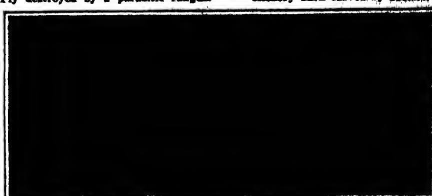
While these virtues must be regarded in the light of modern science as of course entirely imaginary, the ownership of such a protection may have proved, to some extent, an involuntary and hypnotic aid to the sufferer. As a consequence, considerable value was often attached to notably fine specimens of bezoars. In India, especially, their value increased enormously in proportion to their size and choice specimens commanded very large prices.

They were mounted, according to their dimensions, for display or for suspension from the person, special care being taken to leave the bezoar substance plainly visible. In many instances, as the accompanying illustrations, made from photographs of gold-mounted specimens preserved in the Court Museum at Vienna demonstrate, they were even in Europe thought worthy of being inclosed in costly and artistic settings, by which, of course, their value was enhanced to a corresponding extent.

Readers are invited to contribute photographs of [illegible] objects, unique occurrences and [illegible]. [illegible] available will be paid for promptly.

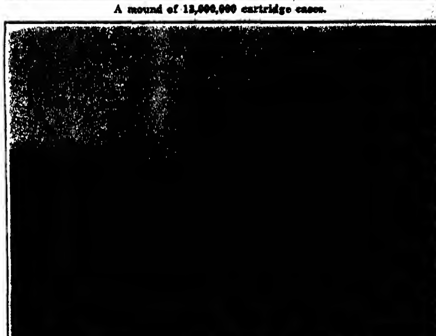
Fly destroyed by a parasitic fungus.

Hickory bark carved by beetles.



Gold-mounted bezoars in Vienna Museum.

A mound of 13,000,000 cartridge cases.



The largest fire engine in Europe [illegible]

T[illegible]

Marking Sheep Without Injury to Wool or Skin

M. ROLLIN has just [illegible] to the National Society of [illegible] of France an excellent method of marking sheep, reported in *Les Annales*.

The sheep can be branded with a hot iron only on the cheeks or forehead, which are bare of wool, or on the horns. Hence many farmers and merchants make use of pitch or coal-tar to mark the wool. But these substances become inseparable from the wool. "Or rather," as Rollin remarks, "they melt and spread when the grease is being removed from the wool, blackening and soiling the fleece."

Traces of them are found in all ulterior operations, and even in the tissues. Skin and wool dealers buy such fleeces at reduced rates. Hence it is desirable to find another method of marking. It has been proposed to use aniline colors, but this is even worse, since the colors do not merely soil the fleece, but actually dye it.

Other means are not lacking, notably that of tattooing the ear of the sheep. Also, a small metallic plate can be fastened in the ear, as is done with African sheep to prove that they have been "clavelised," i. e., inoculated with the special serum which combats their dangerous and contagious eruptive malady, rot or scab.

The Syndical Chamber of Commerce and Industry advises the employment of a color composed of linseed oil, essence of turpentine and Prussian blue or similar color. It recommends marking on nose, forehead, or nape of neck.

Thirteen Million Cartridge Cases

AT first thought one might be inclined to think that the accompanying photograph showing a mound of 13,000,000 cartridge cases was taken on some battlefield in the Balkans. These are not rifle cartridges, however, but paper shells from shotguns and the pile was collected at the Hendon School of Shooting in England. It is a testimony to the love of hunting for which the British are noted, and it shows how the Englishman will take infinite pains to make himself proficient in this class of sport.

Testing the "Imperator's" Bulkheads

THE giant transatlantic liner "Imperator," which is rapidly nearing completion at Hamburg, Germany, recently underwent a very rigid test in order to determine the efficiency of her bulkheads under extreme conditions. A number of the compartments were filled with water to prove the strength of the steel bulkheads. The water was then pumped out by the largest fire engine in Europe. The accompanying photograph shows the "Imperator" at her dock with the great fire engine being lifted to her deck. As compared with the enormous bulk of the great liner, the fire engine is very insignificant. The test proved that the bulkheads would be equal to an emergency such as befell the ill-fated "Titanic." To further safeguard the "Imperator," efficient mechanism is being installed for launching lifeboats under unfavorable conditions. Anti-rolling tanks in the vessel will remove the danger of the lifeboats' being crushed against the sides of the ship while being lowered. One of the lifeboats is equipped with a wireless telegraph system having a range of [illegible] miles, the antenna being a [illegible]. This lifeboat will serve as the [illegible] of the [illegible] of lifeboats in case of a [illegible].

[illegible] by an enemy [illegible] of nations. In all [illegible] by fortification. Sea [illegible] Kiel Canal, are protected [illegible] the Suez Canal an exception [illegible] England, with her fortresses at Malta [illegible] in Egypt, and a navy superior [illegible] two powers, has assured herself [illegible] violation of the terms of the [illegible] And, as a matter of history [illegible] herself did not consent to the [illegible] of the Suez Canal so long as the un[illegible] of her occupation of Egypt rendered [illegible] that she might have to use the canal [illegible] asset. At the time of the convention of [illegible] in 1888 in regard to the Suez Canal, the [illegible] delegates made the following reservation:

"The delegates of Great Britain in presenting this [illegible] as the definite regime intended to guarantee the free use of the Suez Canal, considered it their duty to formulate a general reservation as to the application of its provisions in so far as they would not be compatible with the transitory and exceptional state in which Egypt now exist and as they might fetter the freedom of action of their government during the occupation of Egypt by forces of her Britannic majesty." (Studies in International Law. T. E. Hall, p. [illegible].)

It remains to consider briefly certain military objections which have been made to the policy of fortification. In the first place, it has been objected that fortifications were unnecessary for the canal, on the ground that its defense would be assured by our naval forces. This objection arises from a complete misconception of the true function of the navy. The relative function of the land forces in defence of the canal will be the same as in the defence of any other part of our sea coast. The navy can be used to advantage only when operating on the offensive; and it will be free to operate in this manner and to go where it can do the most good, only when our vital interests are not dependent for protection on it alone. To relegate the navy to the rôle of passive defence, and to tie it down to one locality, would not only be the most expensive possible form of protection to the canal, but it would concede to the enemy at once the command of the sea, and permit him to operate unhampered, without danger of interference by our fleet, against all other portions of our coast line. It is in recognition of these principles that the United States, as well as all other powers, has provided fortifications and armed forces for the protection of its important seacoast cities, dockyards, and naval bases. It was due to the securely defended condition of the Japanese ports that their fleet was free to seek out its proper objective—the Russian fleet—without fear of interruption or recall to guard its home ports against raids by the Vladivostok squadron. To secure an effective protection for the canal by means of naval forces only, without at the same time unduly exposing our seacoast to naval attack, would involve an expenditure for battleships so great as probably to be found prohibitive; an equal degree of protection can be maintained by means of fortifications and a military garrison at a very small percentage of such cost.

Again, it has been objected that the canal is so isolated with respect to the United States that it will be impracticable to secure its successful defense. The fact is, on the contrary, that the Panama Canal Zone is unique in its possibility for reinforcement from the United States. Situated as it is upon two oceans, its position lends itself better to a successful defence than does any other of our overseas possessions. Communication with Porto Rico, Alaska, Hawaii, Guam, or the Philippine Islands, can be had by only one ocean. If any enemy gain the naval supremacy on the ocean on which any of these latter possessions are situated, communication with the United States will be interrupted and the possibility of reinforcement stopped. Communication between Panama and the United States, on the other hand, can be had by both the Atlantic and the Pacific oceans. So long as the United States holds the canal, it will be impracticable for the enemy to interrupt communication in both oceans; and consequently the garrison of the Canal Zone can always be reinforced by troops from the United States. Moreover, the canal is much nearer us than it is to any other power of sufficient military strength to be able to [illegible] a large force in transports against the Canal Zone. The defence of the canal virtually reduces to the problem of protecting it against the action of a [illegible] and against such landing parties as can be [illegible] fleet. Against attack from [illegible] can be reinforced by us more [illegible] can be made.

Another objection that has been advanced to the [illegible] appearing in [illegible] for March, 1913, [illegible] and given wide publicity, to the effect that the topography at the Atlantic terminus of the canal is such that fortifications, no matter how strong, would not be sufficient to keep a hostile fleet at such distance from the mouth of the canal as to prevent its destroying our fleet in detail as it emerges in column. As to this, I need only state that since the objection was made the entire matter has been referred to the General Board of the Navy, and its investigation and report has shown that the objection is entirely *unfounded. Their* report makes it clear that if the Atlantic terminus of the canal be fortified, a fleet can emerge from that terminus in the face of a hostile fleet with less danger of damage from the enemy's fire than if emerging from New York city, Boston, or Hampton Roads. I quote certain pertinent portions of the report:

"The General Board believes that the proposed fortifications at the termini of the Isthmian Canal would be invaluable in assisting the transfer of a United States fleet from one ocean to the other, through the canal, in the face of an opposing fleet. The function of the fortifications in this particular is precisely the same at the canal termini as it is at any fortified place from which a fleet may have to issue in the face of an enemy's fleet.

"Guns mounted on shore are on an unsinkable and steady platform, and they can be provided with unlimited protection and accurate range-finding devices. Guns mounted on board ship are on a sinkable, unsteady platform, their protection is limited, and range-finding devices on board ship have a very limited range of accuracy. The shore gun of equal power has thus a great advantage over the ship gun which is universally recognized, and this advantage is increased if the former be mounted on disappearing carriages, as are the seacoast guns of the United States. The mere statement of these elementary facts is a sufficient proof of the value of seacoast guns to assist a fleet in passing out from behind them to engage a waiting hostile fleet outside, provided the shore guns are mounted in advance of, or abreast, the point where the ship channel joins the open sea. Even if somewhat retired from that point they would be useful, but to a less extent.

"At the Pacific terminus of the canal, there are outlying islands that afford sites for fortifications, the usefulness of which in assisting the egress of a fleet in the face of opposition is universally admitted, as far as the General Board knows; but there has been unfavorable criticism of the possibility of fortifications at the Atlantic end to serve this purpose. The General Board regards these criticisms as unfounded and believes, on the contrary, that the conditions at the Atlantic terminus of the canal are unusually favorable for the emplacement of guns that would be of assistance to a fleet issuing in the face of hostile ships.

"On both sides of Limon Bay, in which the canal terminates at the Atlantic end, there are excellent sites for forts, well advanced on outlying points. The line joining these sites is 3,000 yards in front of the point where the canal prism reaches a low water depth sufficient for battleships, and Limon Bay from this point outward is wide enough for a formation of eight ships abreast. The outer end of the most advanced breakwater proposed is only 600 yards in front of the line joining the sites for the forts; and as long as ships remain behind the breakwater, it will afford them a considerable amount of protection from the enemy's fire, while they will themselves be able to fire over it. In order to make his fire effective against the issuing ships the enemy must come within the effective fire of the fortifications. Under these circumstances it is impossible to deny the usefulness of fortifications in assisting the issue of a fleet against opposition. The conditions in this respect at the Atlantic end of the canal are incomparably better than those existing at Sandy Hook, whose forts nobody would dream of dismantling."

To sum up, fortifications and a military garrison will serve the same purpose on the Panama Canal Zone as is served by the fortifications and garrisons in and around our important seacoast cities. They will free the fleet and permit it to fill its legitimate functions in seeking out an opposing fleet of the enemy; they will prevent the bombardment of the locks and operating machinery (which are not, as has sometimes been asserted, too far inland to be damaged by ships' fire); they will enable our fleet to be transferred in safety from one ocean to the other in the face of an opposing fleet; and they will prevent the destruction or seizure of the canal by a raiding force of the enemy. They are the only means, other than those which would arise through the adoption by the United States of a naval policy similar to that of England, by which the United States may assure to itself the continued possession and control of the canal.

In this discussion I have avoided criticism of the efficacy of international agreement or treaty to accomplish the ends at which the treaty is aimed. I have assumed for the purpose of argument that the treaty or international agreement when made will not be broken under the stress of war. As a matter of fact, we have no right to make such an assumption in regard to a matter of such vital national interest as the security of the Panama Canal. Turkey and Korea are two recent examples of nations which have intrusted the [illegible] of their national integrity and home [illegible] to the protection of international agreements. The independence of Korea was guaranteed by four of the great powers in 1902. It had been previously acknowledged by the treaty of Shimonoseki in 1895 between China and Japan; yet on February 9th, 1904, less than two years after the later guarantee, the Japanese naval commander at Chemulpho violated with impunity the independence of that port and notified the Russian commander of the fleet that unless he left the harbor he would be attacked at his anchorage, and at the same time warned the commanders of the neutral vessels present in the harbor to take measures for the safety of their ships.

Shortly after this incident Japan established in effect a protectorate over Korea, which has been described by an authoritative English writer on international law as constituting "an undoubted infraction both of the treaty of Shimonoseki and of the Anglo-Japanese convention."

Even as I write the Turkish army in front of Constantinople is fighting to accomplish what none of the great powers who were parties to the treaty of Berlin and interested in the preservation of the Ottoman Empire has, as yet, lifted a finger to effect.

In 1908 Austria-Hungary annexed Bosnia and Herzegovina, notwithstanding the fact that Austria-Hungary was one of the seven signatory powers to the treaty of Berlin in 1878, which left the sovereignty of Bosnia and Herzegovina with Turkey. This action, while supported by one and resented by other signatory powers, invoked nothing more from any of them than an expression of dissatisfaction. The incorporation of Eastern Roumelia with Bulgaria, and the declaration of independence by the latter country in 1908, were further violations of the treaty of Berlin; violations that also were permitted to pass without effective protest by the signatory powers to that treaty. In the words of an eminent authority on international law, these acts have "demonstrated how worthless the treaty of Berlin is in restraining political action in the Balkan Peninsula."

In 1790 the Kingdom of Prussia guaranteed the independence of Poland; in 1792 Prussia played the leading part in the partition of Poland. In 1807 Great Britain, without any excuse, except that she deemed it necessary to her military policy, entered the harbor of Copenhagen, belonging to a nation with which she was at peace, and ruthlessly destroyed the Danish fleet.

These instances, selected at random, serve to indicate that it is not always wise or prudent to trust the protection of an invaluable national possession to international agreement or treaty faith. They serve to justify the remark of Mr. W. E. Hall, perhaps the most eminent living authority on international law, to the effect that "treaties are only permanently obeyed when they represent the continued wishes of the contracting parties."

III. Character of the Fortifications and Defences.

Necessarily only a general description of these can be given. What has been said heretofore indicates the object of such fortifications and the purpose which they are intended to subserve. The defences to the Isthmus are divided into two general heads:

"1. A seacoast armament with submarine mines at the termini of the canal, for protection against a sea attack and to secure a safe exit for our fleet in the face of a hostile fleet.

"2. The construction of field works and a mobile force of troops to protect the locks and assure important utilities against an attack by land."

The seacoast fortifications will include 10-inch, 14-inch, and 6-inch rifles, and 12-inch mortars. This armament will be of more powerful and effective types than that installed in any other locality in the world. At the Atlantic end of the canal the armament will be located on both sides of Limon Bay. At the Pacific end the greater part of the armament will be located on several small islands, Flamenco, Perico and Naos, which lie abreast of the terminus. Submarine mines will complete the seacoast armament and will prevent actual entry into the canal and harbors by hostile vessels.

In addition to these fortifications, and the necessary coast artillery and garrison to man them, the defensive plans provide for the erection of field works, and for the maintenance at all times on the Panama Canal Zone of a mobile force consisting of three regiments of infantry, at a war strength of nearly 2,000 men for each regiment, a squadron of cavalry, and a battalion of field artillery. These latter fortifications and the mobile garrison are intended to repel any attacks that might be made by landing parties from an enemy's fleet against the locks and other important elements or accessories to the canal. As an attack of this character might be coincident with or even precede an actual declaration of war, it is necessary that a force of the strength above outlined should be maintained on the Canal Zone at all time. This mobile garrison will furnish the necessary police force to protect the Zone and preserve order within its limits in time of peace. Congress has made the initial appropriations for the construction of these fortifications, and they are now under construction. A portion of the mobile garrison is also on the Isthmus, and the remainder will be sent there as soon as provision is made for its being housed.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

CAP.—C. I. MINKOFF and L. KRONTHAL, 137 Grand St., New York, N. Y. This invention relates generally to caps and more particularly to adjustable caps, such as disclosed in the U. S Letters Patent issued to these inventors. The construction and arrangement is such that one cap may be worn by persons requiring caps of different sizes.

SKIRT MARKER.—MARIE ANDERSEN, 267 51st St., Brooklyn, N. Y. The primary object of this invention is the production of an apparel apparatus which will be of simple and comparatively cheap construction and which may be used by any women whereby she may fit her own skirt with ease and accuracy.

Electrical Devices.

CIRCUIT CLOSER.—C. A. CASTLE, Oldham, S. D. This invention provides a closing device adapted to be connected across the lines of a telegraph circuit at a station whereby, if the key within the station should be left open or a plug between the key and the connections to the circuit closer be removed, thereby opening the line, the device will be actuated by means of a local circuit in order to close the line.

TELEPHONE RECEIVER HOLDER.—S. C. SLADDEN, 305 5th Ave., Manhattan, N. Y., N. Y. The invention provides a holder which, when disposed in service, is mechanically supported; provides a support which, when released from service position, automatically opens the telephone circuit and to close the bell circuit; provides a holder arranged to compel the proper disposition of the parts of the instrument; and provides a holder in the shape of an attachment to the ordinary telephone instrument, adapted for use thereon without altering or interfering with the construction of the instrument.

Of Interest to Farmers.

CULTIVATOR.—R. C. DOUGAN, Drawer 7, Millersburg, Ohio. The intention in this case is to provide a simple device which will thoroughly work up and disintegrate the soil, and wherein means are provided for guiding or steering the cultivator as it is drawn through the field.

HOEING MACHINE.—W. R. STURGIS, 519 Concert St., Keokuk, Iowa. The object here is to provide a simple, easily operated and economical machine wherein mechanism is provided for hoeing and thinning of plants in a manner closely resembling the thorough operation of hand working.

HEATING SYSTEM FOR INCUBATORS.—G. H. LEE, 1115 Harney St., Omaha, Neb. This inventor provides means whereby the temperature in an incubating chamber may be distributed to equalize or vary the temperature of various parts of the chamber at will; provides means for arresting the smoke or fumes emanating from the ordinary heater lamp; and provides registers for regulating distribution of the heat.

Of General Interest.

TILE SETTER.—G. W. MCGARDY, Marshall, Minn. This improvement involves a device for use in setting tiles in position in wells or similar excavation, and the principal purpose of the invention is the provision of a device which will perform the work in an efficient manner

NEWSPAPER HOLDER FRAME.—H. ZUM FELDE, 758 E. 225th St., New York, N. Y. This invention preferably comprises an arrangement of supporting bars in which is mounted a number of spring-pressed rods adapted to engage the top of a pile of papers with sufficient force to hold them in place against gusts of wind, but not too tightly to prevent them from being pulled off the pile, without loosening the rods by the customer.

PHOTOGRAPHIC PRINTING DEVICE.—M. F. LONG, 110 W Superior St., Duluth, Minn Light entering this device will not be transmitted directly to the negative from which the photographic print is to be made, but will first fall upon a mirror carried on the interior of the casing of the printing device and be caused to pass, by reflection, therefrom to a suitable opening in which the negative is held in place Suitable plates modify the light passing into the device when the paper to be printed is put into position, the object being to illuminate the negative with non-actinic rays, to allow the user to see where to place paper on the negative at the start

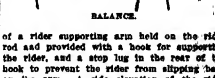
AIR SUPPLY DEVICE FOR FIREMEN.—J. D. HALLORAN, 56 Baxter Ave, Elmhurst, L. I., N. Y., N. Y. This device utilizes the action of the water passing through the fire hose for drawing in fresh air and delivering the same to one or a number of firemen for breathing purposes, thus enabling those in charge of the fire to readily combat a fire in the holds of vessels, cellars, etc.

FINGER EXERCISER.—J. R. MANNERS, P. O. Box 115, Jefferson, Ind. The object of the invention is to provide a simple device adapted to engage certain fingers of either hand and leaving any desired finger free, whereby that finger may be exercised in various ways depending on the calling of the person.

REFUSE RECEPTACLE.—S. MERKOWITZ, 293 Stockton St., Brooklyn, N. Y. An object here is to provide a refuse receptacle with a cover which can be readily opened for the purpose of depositing refuse therein, and with an auxiliary door or cover which can be opened for the purpose of removing the refuse from the receptacle.

Hardware and Tools.

BALANCE.—G. VOLAND and G. G. VOLAND, New Rochelle, N. Y. For the purpose of this invention use is made of a rider rod provided with a resilient finger adapted to engage the beam on turning the rod with a view to impart a swinging motion to the beam to test the sensitiveness thereof. Use is also made



BALANCE.

of a rider supporting arm held on the rider rod and provided with a hook for supporting the rider, and a stop lug in the rear of the hook to prevent the rider from slipping back on the arm. A side elevation of the rider carrier, as applied to a balance in dormant position, is shown in the engraving.

DEVICE FOR FASTENING SHADES TO ROLLERS.—G. W. FOUNTAIN and S. H. HOOK, Cameron, Mo. This invention provides an elongated flexible fastener with projections on one face for engaging the shade and the roller, there being a slot at one end of the fastener, in which a pointed terminal at the other end is normally disposed and turned over, for holding the fastener around the roller and an end of the shade, the fastener being provided with laterally extending shoulders for engaging and holding the end of the shade in place.

SUPPORT FOR TOOLS.—J. J. DELEHANTY, 652 W. 47th St., Chicago, Ill. This improvement pertains to supports for tools, the more particular purpose being the provision of a neat, handy, and simple form of portable support for such tools as are usually employed by carpenters, steam fitters, plumbers, and the like.

SHADE SUPPORT.—A. R. SMITH, care of E. Witzman & Co., 99 N. 2d St., Memphis, Tenn. The two telescopic members of the support have brackets for carrying the shade roller, each of the members having lugs around which a cord is disposed so that the members are held firmly to the cord when it is drawn taut, the cord being disposed around pulleys which are mounted to permit of the cord being conveniently drawn taut, and the pulleys so supported that they are readily removed and replaced.

SAFETY RAZOR.—D. W. WOOD, care of McNutt & Shattuck, 12 Knight Block, Brazil, Ind. In this instance the invention refers to safety razors, and the aim is to provide a razor which is adapted to all portions of the face, and which will give a transversely shearing cut when drawn longitudinally across the same.

Heating and Lighting.

OPENING DEVICE FOR FURNACE DOORS.—J. WHEELER, 811 So. 2d St., Cripple Creek, Colo. Mr. Wheeler's invention refers to a device for opening doors of furnaces, especially engine furnaces. An object is to provide means whereby the door of a furnace may be opened by stepping on a pedal and will automatically close when the pedal is released.

STAY BOLT AND MEANS FOR SCREWING THE SAME IN PLACE.—W. L. DECKER, per Callcia No. 9, Mollendo, Peru. This invention has in view a means for rigidly connecting the inner and outer walls of the boiler with each other and thus prevent the walls from bulging under pressure, and permitting of conveniently and quickly screwing the stay bolt in place or removing it when necessary.

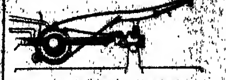
COMBINATION GAS BURNER AND ELECTRIC GAS IGNITER.—H. D. GRINNELL, Agricultural North Bank Bldg., Pittsfield, Mass. This invention is for use on acetylene or other gas lamps for illuminating purposes on automobiles and other places, and arranged to prevent electric wires from disturbance and to insure proper transmission of electricity to the electrodes used for producing a spark in the path of gas issuing from the burner of the lamps to ignite the gas whenever it is desired to use the lamp.

Household Utilities.

COOKING APPARATUS.—HARRIET J. FELL, care of Dorrilton, Broadway & 71st St., New York, N Y. This apparatus is for use in broiling, toasting or otherwise treating articles of food, and is arranged to permit of conveniently holding the article of food in position in a holder or gridiron to allow of readily turning the holder or gridiron periodically and locking it in the adjusted position.

Machines and Mechanical Devices.

PAPER GUIDE.—ALICE U. DAVIS, Box 810, El Paso, Tex. This invention provides means for guiding the paper and [illegible] to and from a typewriting machine, [illegible] to prevent the [illegible] of [illegible] paper or carbon inserts [illegible] delivering from the platen, and [illegible] for holding the paper, which are [illegible] and durable in construction. An [illegible] in the use of the device is that the [illegible] car-



PAPER GUIDE FOR TYPEWRITERS.

bons are prevented from falling or curling between the leaves of the paper before the paper and carbons enter the paper feeding device, thus preventing blank spaces on the carbon copies. The illustration gives a side view of a fragment of the frame of a typewriting machine, showing in conjunction therewith means for guiding the paper on delivery from the platen.

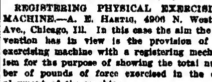
SAFETY DRAWBRIDGE ATTACHMENT.—E. F. SCHOENTHALER, Long Branch, N. J. By means of this attachment the entrance to either or both sides of the drawbridge may be guarded when the bridge is open, so as to prevent accident. An object is to provide means whereby a single man can manipulate the guard gates at the bridge entrance from

SAFETY DRAWBRIDGE ATTACHMENT.

a point where the manipulation of the bridge itself is controlled, such as the engine-house on the bridge. The gates can only be opened conveniently when the bridge has returned to its position in alinement with the roadway, the gates being operable either from above in the engine-house, or below on the bridge itself. The engraving represents a perspective view broken away to show the underlying structure.

REGISTERING PHYSICAL EXERCISING MACHINE.—A. E. HARTIG, 4906 N. Western Ave., Chicago, Ill. In this case the aim the invention has in view is the provision of an exercising machine with a registering mechanism for the purpose of showing the total number of pounds of force exercised in the employment of the machine.

FIREARM.—B. F. CASE, P. O. Box 218, Mitchell, Ind. This inventor provides a firearm having an extractor movable longitudinally of the barrel, and rotatable therewith on a stud mounted on the breechpiece, so that



FIREARM.

when the barrel is rotated the extractor will engage a member on the stud, which will hold the extractor against movement when the barrel is moved longitudinally away from the breechpiece, the extractor in this way removing from the barrel the shell. A side elevation of the firearm is shown herewith partially in section, the firearm ready to be fired.

ATTACHMENT FOR TYPEWRITERS.—L. LAMARQUE, San Miguel 226 Altos, Habana, Cuba. This invention facilitates the winding and unwinding of the typewriter ribbon; provides means for printing at practically a single stroke, an entire line or part of a line or repeated characters, such as dots or stipples; and provides a special mechanism for carrying out these purposes and improving generally the efficiency of the typewriting machine.

Prime Movers and Their Accessories.

AUTOMATIC SPARK ADVANCER.—C. C. CHARLES, Hoisington, Kan. The invention comprises suitable apparatus for operating the casing of the timer which closes the circuit supplying current to the igniter, in such a way that when the engine speed increases, the instant at which the circuit is closed to operate the igniter is automatically advanced so as to cause the spark to be produced at the required point before the piston reaches the inner dead center.

Railways and Their Accessories.

CAR COUPLING.—AUGUST L. [illegible], care of Bertha L. Kahne, 900 W. [illegible] Ave. [illegible]

[illegible] metal.

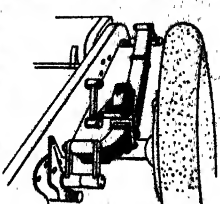
[illegible]

TOY BOOMERANG.—G. H. LEE, 1115 Harney St., Omaha, Neb. The inventor provides a missile which when properly thrown has a trajectory similar to that of a boomerang, returning to or near the thrower; provides a missile the trajectory of the flight of which is spiral; and constructs a toy in the simplest and most durable form.

Pertaining to Vehicles.

ELECTRIC DRIVING GEAR FOR MOTOR VEHICLES.—W. H. DOUGLAS, care of Healy & Co., 1659 Broadway, N. Y., N. Y. The inventor provides a motor drive for automobiles and other vehicles, arranged to insure proper transmission of the power from the motor to the axle to counterbalance the motor and driven parts, and to allow the motor to oscillate in any direction, thus compensating for jolts and twists incident to running over rough roads.

REBOUND CHECK.—W. A. FOWLER, Fairmount, West Va. This appliance eliminates the rebound of a car without interfering with the downward action of the springs. A rebound prevents the much desired resiliency of the spring and makes the shock to the chassis more violent. This device runs idle on the downward action of the car body and, therefore, receives half the wear of other devices



REBOUND CHECK.

designed for this purpose. All working parts of this device are housed and the gear case is packed in grease and rendered noiseless. Spring action against the wedge keeps the moving parts in contact thus avoiding any hammer or rattle. The noiseless heavy duty ratchet will operate on the instant it is reversed, and this is a feature aside from its application to the motor car. The drawing shows a perspective view of the invention in place.

Designs.

DESIGN FOR A REINFORCED KETTLE.—E. C. HOFFMANN, care of H. M. Kidder, Scribner, Neb. This ornamental design is of a reinforced kettle of excellent proportions and outlines of graceful curves.

DESIGN FOR A COVERED DISH OR SIMILAR ARTICLE.—C. E. SIEBLER, Altwasser, Germany, care of W. Guerin & Co., 33 Park Place, New York, N. Y. This oval shaped covered dish has a handle at each end of and midway of the body of the article, and from these the body slants toward the cover and the base. The last is flat and the cover is rounded with a handle in the center. The design is beautiful in its simple outlines.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

Inquiry No. 9288 Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289 Wanted substance melting at 225° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor

Inquiry No 9290 Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size

Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Introducing Great Inventions

Some Historical Instances

By William Atherton Du Puy

THE pessimistic inventor who holds that the hand of all the world is against him and that his ideas are so ahead of the times that they may not be appreciated until he is dead and gone is still abroad in the land. He believes that he has the facts from which to draw a conclusion that he who makes an invention that is revolutionary is to suffer many reverses and to wait long for his reward There are many cases of record to substantiate this belief There is, however a question of their application to the inventor of to-day

There is the case of Sir Henry Bessemer for instance and his difficulty in inducing the world to use his obvious and revolutionary methods of producing steel So great was the effect of the Bessemer process upon the steel business that the production in England jumped from 50 000 tons a year to 4 000 000 tons immediately after its introduction and so great was the effect of the cheaper methods of refinement upon price that steel declined from $300 a ton to $40 a ton Yet the only way Bessemer could get his process used was to put up a factory manufacture steel and undersell his competitors

Bessemer went at the problem of improving the manner of making steel deliberately He wanted a stronger metal for the barrels of big guns He knew nothing of the business. He began at the bottom and learned the science of it In the end he made a retort with provision for forcing air in from below He melted his iron and turned on the air The whole immediately became a sparkling furnace that burned so hotly and so rapidly that it was impossible to reach the valve which would turn off the air So hot was the fire that the very fastenings of the retort were nearly melted The transforming process was however completed before the heat had demolished the plant So was the discovery made

Yet those people with whom Bessemer contracted for the use of his process failed utterly in getting results and abandoned it He formed a company of his own built a plant and began the production of steel This he sold at a price that the producers under the old process could not meet and still made a fabulous profit Thus he proved the value of his patents and after many years brought them into general use and from the royalties he received he waxed fabulously rich

C Francis Jenkins is one of the inventors of that familiar entertainer of the ninety millions which is now to be seen in every town and hamlet of the nation the moving picture For four years he worked upon the moving picture idea before he finally hit upon the key to the whole situation which made the productions as they are seen to-day actually possible It all depended upon the size of a hole in a shutter and that which Jenkins made was the right size. Because of this, his machine worked

Yet this great invention was a thing which led its maker immediately into unlimited worry and harassment In the first place he attempted to popularize the moving picture and to put it on as a show as it is now put on in so many thousands of theatres. This proved a herculean task The moving picture was a thing so novel that there was nothing with which to compare it. The public could not be reached by a word of mouth explanation of it An advertisement could not be written that would carry home an appreciation of what this thing was. The people could not understand, that it was anything more than a magic lantern machine through which one picture after another was drawn

The first moving picture show that was ever put on and asked for public patronage was at the Cotton States' Exposition in Atlanta, in 1895. People would not pay admission to the show; so finally the doors were thrown open to the public and they were asked to leave a quarter at the box office after the show if they considerpd that they had been entertained to that value

The inventor's second disappointment

was due to the fact, that before the [illegible] of the patents litigation had [illegible] one which has lasted without [illegible] to this very day and which has every [illegible] of continuing until the [illegible] the patents expire. Franklin Institute of Philadelphia, early extended to Jenkins the Elliott Cresson gold medal in acknowledgment of his accomplishment. This was a great satisfaction to the young inventor. Yet, so harrassing was the litigation as well as the difficulty of popularizing the machine, that he eventually sold it outright. For this invention which has earned tens and probably hundreds of millions, he received $5,500. Despite the smallness of this sum and the far reaching nature of the invention Jenkins says, he has never been sorry of the sale.

Alfred Nobel, the man who has done the mass of the world's work toward the development of commercial explosives and has thereby made modern mining, canal building, railroad building and kindred industries possible, suffered untold discouragements and temporary defeats before he finally attained success. In the end, however, he amassed a huge fortune, $12,000,000 of which he set aside and provided that the income from it should, each year, be distributed in prizes to the men of the world who did most for progress.

Nobel was very delicate in health from birth and his battles in making explosives possible were, from first to last, in the face of physical suffering that would have discouraged any but a man of superb determination. His life was largely spent in Scandinavia and in St. Petersburg. It was sixty years ago, that he first undertook the task of making the transportation and handling of nitro-glycerine comparatively safe. As Bessemer began his experiments with steel that he might develop greater strength in gun barrels, so did Nobel begin his studies of explosives that he might develop a stronger charge for use in them.

Nitro-glycerine, when it comes in contact with the hands, produces intense headaches. Nobel, delicate, nervous and supersensitive, suffered intensely from headaches caused in this way for the twenty-five years that he handled the explosive. Likewise did he constantly run the risk of being blown to pieces by the materials that he handled. The tragedies that resulted from his efforts but which he escaped by accident, show the danger to which he was exposed.

Early in his investigations, he went far toward removing the danger from nitro-glycerine. Over and over again, he demonstrated in his very hands the safety from explosion of his product. Unquestionably his first steps went far toward accomplishing the great feat. Finally, a ship load of his preparation was started for Chile. In mid-ocean it blew up and recorded one of the great tragedies of its time. Because of this explosion all the world turned from his invention and upon him. No one would use his explosive. There was even an effort made to make its transportation anywhere in the world unlawful.

Nobel acknowledged that his problem was not yet worked out and he labored for yet another ten years. The final solution he happened upon by accident. While working in his laboratory, he cut his finger. He sent out for collodion with which to dress the wound. Collodion is made of gun cotton dissolved in some volatile solvent such as ether. The combination is spread on a wound, the ether immediately evaporates and the dressing of gun cotton is left as a sort of artificial skin. After dressing the wound he poured the remaining collodion into some nitro-glycerine with which he was working. The ether evaporated out and the gun cotton remained, converting the whole into a sort of gelatine. He experimented with this accidental product and found it the safest explosive yet developed. It was at about this time, however, that he got his second set-back, for his factory exploded disastrously and so was the industrial world given another scare from which it required another decade to recover. The clamor of the engineering world for an explosive, the desire to wrest treasures from the bowels of the earth, to cut roadways in [illegible] [illegible], to link ocean with ocean through the [illegible]

[illegible] taken out a patent. [illegible] vestor for many years [illegible] inventors. I used to hear [illegible] from these men because of the difficulty of placing a good idea. I hear these complaints no more.

"Take such a case as that of the telephone. There must needs be some difficulty in introducing it for the idea is so novel, that it cannot be readily [illegible]. It must also be remembered that the telephone was a very indifferent transmitter of speech for a long time after it came into partial use. The delay in its adoption was very largely due to the fact, that it was not yet perfected and this is true of many inventions that are slow in getting hold. The average inventor applies in some given industry. The people who are making big money out of that industry are always anxious for any improved appliance. The man who invents something of actual practical use needs but get in touch with the people who should use it and his reward is almost immediate. This is particularly true of America, where invention has done so much and where rivalry is so intense, that each man is grasping for anything that will give him a small advantage over his rival."

The Arlington Wireless Telegraph Station

WORK on the Naval Wireless Telegraph Station at Arlington, Virginia, is rapidly nearing completion. On October 29th, the apparatus was put to a partial test. The signal N.A.A. of the Arlington Station was repeatedly flashed in the effort to reach Key West, but for some reason it was impossible to reach that station. However, when the receiving apparatus was tested, the operators were able to take messages sent from the Marconi station at Clifden, Ireland, a distance of 2,500 miles. When the Arlington plant is completed, and working under full power, it is confidently expected that communications will be established not only with Key West, but with Panama, San Francisco, and San Diego.

The Use of Aeroplanes in Actual Warfare

NOW that hostilities have broken out between the Balkan States and Turkey, it is interesting to know that both sides have a number of aeroplanes and pilots to man them. A number of monoplanes were used with excellent success by the Italians in the war with Tripoli. On August 24th Lieut. Manzini fell into the Mediterranean and was drowned while reconnoitering in this war. Turkey has a dozen or more officer aviators who have learned to fly in England and in France. These men are pilots of Bristol, Blériot, and R. E. P. monoplanes, and of Farman biplanes. The Servian Army has three aviators and machines of the Blériot type, and the Roumanian and Bulgarian armies also have strong forces of aviators with various types of aeroplanes. There are several good Montenegrin military aviators, and the Greek officers who learned at the Farman school in France have shown themselves to be excellent flyers. The Bulgarian army has six or more Bristol monoplanes, while at the Roumanian army maneuvers the first part of last month, Mr. [illegible] made some excellent demonstration flights with one of these English machines.

The Italian and [illegible] aviators [illegible] Abramovitch [illegible] from Berlin to St. Petersburg [illegible] [illegible]

[illegible] were pilots of Wright biplanes. The latter, who was the pioneer Russian aviator and the chief instructor of the Russian army, made several excellent scouting flights over the Turkish lines in the vicinity of Adrianople. According to press reports, on the 31st ultimo, while soaring over this besieged city, his machine was struck by a schrapnel shell and Popoff fell to his death. A Farman biplane was used by the Greeks for scouting before the invasion of Turkey was decided upon. The country was flown over within a radius of 50 miles, and when no Turkish troops were found, the invasion was immediately begun.

Notes for Inventors

Twelve Eye-glass Patents.—The patents issued October 1st, 1912, include twelve patents numbered from 1,040,094 to 1,040,105, inclusive, to Leo F. Adt, of Albany, N. Y., for eye-glasses or eye-glass mountings.

Dries by the Aid of Magnetic Field.—In patent No. 1,040,486 William H. Allen, of Cleveland, Ohio, presents a method of desiccating an organic substance by subjecting the substance to the action of a magnetic field in a compartment and circulating cool dry air through such compartment.

Combines a Bottle and Drinking Cup.—Fortunatus F. Syracuse, of New York city, in patent No. 1,039,843 shows a cup in goblet form with a hollow standard communicating with the chamber of the cup and in the chamber is fitted, removably, a flexible and elastic bag whose neck is secured in the standard of the cup, the neck being sealed and the body of the bag lying normally within the chamber of the cup.

A Fessenden High-frequency Electrical Conductor.—Reginald A. Fessenden, Brant Rock, Mass., assignor to National Electric Signaling Company, of Pittsburgh, in patent No. 1,039,717 presents a coil for high-frequency currents in which a strip conductor formed of a number of wires is wound edgewise and the position of the wires in the strip are varied in spiral fashion and in opposite senses with the length of the strip and are also plaited.

A New Toy Whistle.—A toy whistle having two whistles spaced apart like the ordinary tin, penny whistle and connected by a tubular bellows to retain the air and a spring within the bellows to force the whistles normally apart so that by compressing and releasing the end whistles rapidly, a practically continuous whistling sound will be produced, is disclosed in patent No. 1,039,840, issued to Victor Silva Sacavem of New York city.

Another Everflowing Bottle.—An inclined bottle mounted on standards with that nearest the uptilted bottom of the bottle hollow and extended into the bottle and curving downwardly at its discharge end to prevent splashing in the bottle is shown in patent No. 1,041,149 to Chas. W. Nichols of Rahway, N. J. The bottle discharges into a small tank and a pump circulates the water from the tank through the hollow standard into the bottle from which it pours into the tank.

Double Compartment Condiment Holder.—Patent No. 1,039,729, granted to Jacob Gottlieb, of New York city, covers a condiment holder with a partition to form compartments and a perforated top, while between the top and the compartments there is provided an inclined wall which is revolubly mounted to revolve horizontally so that it can be set to shut off one or the other of the compartments and to convey the substance of the other compartment to the sifting top so that salt or pepper can be discharged at will.

Novel Arrangement of Automobile Seats.—Franklin J. Morgan, of Chicago, shows in patent No. 1,039,780, the arrangement in connection with a steering mechanism at one side of the body of an automobile of three seats disposed in a single row and each comprising a complete seat and back. One of the end seats is located immediately in rear of the steering mechanism and the middle seat is [illegible] offset in rear of the line of the adjacent end seats

and its back is correspondingly offset. The occupant of the middle seat is so situated that he will not cause any interference with the steering operations.

Supplies Air to Firemen.—A patent, No. 1,040,311, has been issued to James D. Halloran of New York, N. Y., for an air-supply device in which there is combined with a fire hose a nozzle and an air-suction device connected with the nozzle at the discharge end thereof for drawing in air by the passage of the water through the nozzle, a main air-supply pipe being connected with the suction device and tapping means being connected with the main air-supply pipe with distributing devices connected with the tapping means so that the air may be distributed to the firemen for breathing purposes.

Legal Notes

Difference Between an Assignment and an Option to Purchase.—Assistant Commissioner Tennant in the case of Newman has decided that while the assignee of the entire interest in an application for patent may be permitted to prosecute such application for patent to the exclusion of the inventor, the Patent Office cannot recognize a party having only an option to purchase.

United States Cancels Three Patents.—By a decree of the United States District Court for the Eastern District of Pennsylvania, entered July 18th, 1912, in the case of the United States v. John Allen Heany, patents numbered 839,585, 842,546 and 872,936 were canceled and a copy of the decree has been recorded in the assignment records of the United States Patent Office. Heany was involved in fraudulent transactions relating to the patents.

Patentability and the Dissolution of Interference.—In the case of Thompson v. Kiely, both parties were applicants for patent and were put in interference and it was held that the fact that each of them moved to dissolve the interference on the ground that the issue is not patentable, does not warrant the dissolution of the interference if the examiner is of the opinion that the issue is patentable, and Assistant Commissioner Tennant said that if the parties do not wish to contest the question of priority they have a remedy by simultaneously filing an abandonment of the invention when the proper action will be a dissolution of the interference.

Trade-marks in China.—A dispatch from Peking states that the Government has under consideration a telegram received from the Chinese Chamber of Commerce in Shanghai requesting the promulgation of a uniform system of registration of trade-marks. W. Roderick Dorsey, the Vice-Consul at Shanghai, in summarizing the present status of trade-mark protection in China, calls attention to the fact that although the commercial treaty between the United States and China of 1903 contemplated protection of trade-marks, patents and copyrights, to citizens and subjects of those countries, no patent laws have as yet been enacted and no Patent Office has as yet been established in China. Provisional registration bureaus for trade-marks have been opened at the Shanghai and Tientsin offices of the Chinese maritime customs where owners of such rights, either personally or by their agents, are invited to register through their consuls, and patents and copyrights are also received for registration. A registration is first effected in the consulate of the country of the applicant and is then sent on to the Commissioner of Customs for registration in the provisional bureau. The result is merely a provisional registration giving tangible evidence of priority of claim of ownership to be considered when trade-mark, patent, and copyright laws come into effect in China and application is made for actual registration. While the protection afforded by this practice is somewhat limited as explained in detail in the *Daily Consular and Trade Report* of the Department of Commerce for July 30th, 1912, it appears to be the only protection offered for this class of commercial property in the Chinese Empire.

The Greatest Engineering Work of All Time.

(Concluded from page 400.)

feet square at the base and 400 feet in height—a mass in other words, which, as our illustration shows, would entirely cover in and shut out of sight, the new Pennsylvania Terminal at New York and tower several hundred feet above the lofty roof of the main hall.

The Chinese Wall has always been considered to be a fairly big job of construction. It is fifteen hundred miles in length, and would reach from San Francisco to St. Louis. But the material taken out of the canal prism would build a wall 2,500 miles in length and of the same average thickness and height as the Chinese Wall, the structure reaching entirely across the United States. Again, the canal from shore to shore is only forty miles long, or fifty miles between the deep-water contours on each ocean. But the same amount of excavation would dig a canal 55 feet wide and 10 feet deep entirely across the United States.

Lastly, if all the excavated material were loaded onto flat cars it would form a dirt train sufficient to reach over four times around the globe; moreover the bore holes driven for blasting out this material, if placed end to end, would pass entirely through the earth.

The Sanitation of the Canal Zone

(Concluded from page 398.)

residence, in the tropics for colonies of northern white races, without any appreciable ill-effect on either their physique or mentality. But their remaining in good health is conditional upon properly conducted measures of sanitary prophylaxis. The question is not "Can a white colony live and labor in the tropics?" but rather, "Can a white colony afford to undertake the sanitary work necessary to make it possible for its members to live in health?" The last question can only be answered by a careful study of the conditions in a given locality. From the experience gained in Panama, in Cuba and in the Philippines, we believe that in most places the cost of sanitation can be made to fall well within the boundaries of economic feasibility, if directed by a competent sanitarian. Whether or not the Caucasian race can permanently inhabit the tropics, continue a healthy vigorous race and maintain a high degree of culture is a question I am not prepared to discuss. That under proper conditions Caucasians can live long enough in the tropics to accomplish a prodigious task of engineering, such as the Panama Canal, and do it without any great sacrifice either in lives or in health, has been demonstrated. To-day healthy and vigorous American men work with snap and vim under the hot sun of Panama, play baseball, tennis and other games. American women do housework, play tennis, ride horseback and dance enthusiastically, and chubby little American children, born and raised in Panama, play on the lawns and attend American schools. We have learned how to live in the tropics.

The Electrification of the Panama Canal

(Concluded from page 397.)

for a considerable period will suddenly be called upon to operate and must perform its function absolutely without fail. To insure this the best of machinery and the best methods of construction have been employed. Very special attention has been given to the conditions of humidity on the Isthmus and a suitable insulation for electrical machines to be used in such a place has been developed, after a study involving much expenditure of time and money. The prevention of corrosion of the metallic parts has also been given especial attention.

For operating the rising-stem gate valves, 116 50-horse-power motors will be employed. The function of these valves is to regulate the flow of water into and out of the locks from the upper level through the main culverts in the side and

center walls. A rising valve stem passes vertically through a stuffing box in a horizontal water-tight bulkhead, in this way closing the bottom of the machinery chamber 32 feet below the high level of the water in the lock. The upper end of the valve stem is carried by a crosshead actuated by two vertical, revolving, non-rising screws, the latter being driven by a 3-phase induction motor by means of a reducing gear from the horizontal shaft. A solenoid brake on the motor allows it to be brought to rest immediately should the line current be interrupted. Arrangements are made so that the machinery may all be operated locally or by remote control, and auxiliary hand apparatus is also provided for closing the gate. The current is cut off at the proper point in the travel of the crosshead by means of a limit switch.

To operate the cylindrical valves, 7½ horse-power motors will be used. There will be 120 of these valves, 20 in each of the single locks. These valves control the flow of water from the culvert in the center wall and in the smaller lateral culverts beneath the floors of the lock from which it rises through the walls into the lock chambers.

For the operation of the lock gates, of which there are 46 pairs, 27 horse-power motors will be required, one to each leaf, 46 7½-horse-power motors will also be required for the miter-forcing machines which force the gates to come together perfectly and then lock them when they are in this position.

For the operation of the chain fenders, pumps will be used and 48 70-horse-power motors will be used for driving these. In order to prevent a ship from ramming the gates in case of accident, these fender chains are stretched across the lock chambers in front of certain miter gates. When not in use these chains are lowered into a well in the floor of the lock chamber. An hydraulic pressure and plunger mechanism is used for lifting and lowering the chains and the water supply for operating this mechanism is obtained by means of motor driven pumps.

In case of damage to the gates or should it be desirable to make repairs, six emergency dams will be erected to check the flow of water through the locks under these conditions. These dams will be placed in pairs in the approaches to the upper locks about 200 feet above the upper guard gates, each one closing the approach to one of the single locks. The turning and wedging of the dam and the lowering of the wicket girders and gates will require four movements. The machines of this operation will be driven by electric motors with hand power possible for emergency use. Two 150 horse-power motors for turning the bridge and a limit switch to prevent operation beyond an arc of 90 degrees, will be located in the operator's house at the end of the short arm on the emergency dam. The wedges will be operated by a 25 horse-power motor, and the bridge will be firmly held in place when it is at rest across the channel or lock wall. A hoisting drum driven by a 25 horse-power motor with its equipment of limit switch will be used for raising and lowering each of the six wicket girders of the dam. The gates on the girders will also be lowered into place by the same means, gravity assisting the electric power. There will, therefore, also be six gate hoisting machines for each dam, a 25 horse-power motor being used with each.

An electrically operated remote control from the center point will be used in connection with the various gates, valves, fender chains, etc., of the locks. There will be one such central control station for each of the series of locks at Gatun, Pedro Miguel and Miraflores. The starting panels which will be placed in each machinery chamber, will be equipped with contactors by means of which current will be applied to the motors. These starting panels will, in turn, be controlled from the central control stations at the lock sites. Some of the machinery chambers will be 2,700 feet from the point of control. Ninety per cent of them will

be within 2,000 feet, and 50 per cent of the total within 1,200 feet. The switchboards which are placed in the central control houses are being made to resemble very closely the plan view of the locks.

The movement of each machine is shown visually to the operator by an indicator mounted on a board which has the same relative location and is constructed to represent it in appearance and travel. The motion of the machine itself is followed by these indicators in practically synchronism, and with a very high degree of accuracy. In order to further assist the operator and to prevent mistakes, a mechanical interlocking of the individual switches controlling the various motor and contactor panels is used, it being thus possible to operate in correct sequence only the various gate machines, fender chains, etc.

The use of electricity in hauling the vessels through the locks by means of electric locomotives is one of the most important uses of electricity on the canal. Forty locomotives will be required and four will be used with each ship: two towing the ships, one on each side of the lock and two locomotives attached to the stern, one on each side for steadying the ship in its passage. The locomotives will have a drawbar pull of 3,400 pounds, and will tow the vessels at a rate of 2 miles per hour, and will return at a rate of 5 miles per hour. All of the towing tracks will have a center rack throughout, and a pinion in mesh with this rack will always be used by the locomotives while towing.

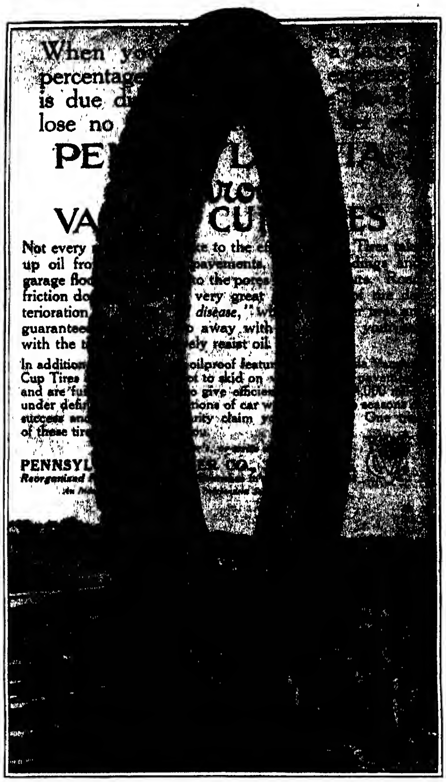
In addition to the above-mentioned uses of electricity, we may name applications for lighting, telegraph system, fire alarm system, system for mining batteries, and, undoubtedly in the extensive fortifications which will be erected; other fields will be found for its application. The use of electricity in connection with the canal has been studied most thoroughly in every detail by the engineers connected with this work, and with reliability of operation as the factor of prime importance. The whole installation will be a monument alike to the development of electrical art and to the care and skill of the engineers to whom this work was entrusted.

Result of the Gordon Bennett Balloon Race

As we go to press nineteen out of the twenty balloons which left Stuttgart on the 27th ultimo, in the Gordon Bennett race have been reported. The race appears to have been won by the French balloon "Picardie," piloted by M. Maurice Bienaimé, with M. Rumpelmayer as aide. This aerostat covered a distance of 2,000 kilometers (1,367 miles) in 46 hours, thus breaking the world's record of 1,211 miles, held by M. Emil Dubonnet, as well as the record of 1,172 miles made last year in this race by Alan R. Hawley, when he traveled from St. Louis to the wilds of Canada. M. Bienaimé landed at Riazan, near Moscow. The French "Ile de France," piloted by Alfred Leblanc, also landed in Russia, about 125 miles short of the distance covered by the "Picardie." The third French balloon, the "Bearn," and the English "Honeymoon" appear to have tied for third place with 1,800 kilometers (1,118½ miles) to their credit, the "Uncle Sam" being next with 1,056 miles.

The third American balloon, "Düsseldorf II.," piloted by Mr. John Watts, who had Mr. Arthur T. Atherholt as aide, had not been heard from up to November 1st, and it was feared this German aerostat, which was loaned the Americans at the last moment owing to a defect developing in their own, had been lost at sea.

This is the first time France has won the international balloon race, and no doubt her aeronauts will make every effort to keep both the balloon and aeroplane trophies at home in the future. No less than nine countries competed this year.



Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12693) H. N. M. writes: In expounding the phenomena of thunder some time ago, I gave the following theory, which I now find to be entirely different from the accepted theories: When electricity passes through water, it decomposes it, producing hydrogen and oxygen, the amount of gas produced varying with the strength or volume of electric current. The heat that decomposes the water, in the case of lightning, ignites the gas, which is reconverted back to water with a terrific explosion, which in a thunder storm is called thunder. When a flash of lightning passes along a cloud horizontally, sometimes in the moisture and sometimes out, it decomposes the water and ignites the detonating gas in its train, and an extended, intermittent, rolling peal of thunder is heard. If it passes through the cloud toward the earth, a short report is the result. Now lightning passing through the air from a cloud to the earth produces no thunder. I have heard it strike a tree close by with a short splitting sound, but the thunder is not heard until after a sufficient lapse of time for the sound to travel from the cloud to the earth. This proves to my mind that water must be present and detonating gas produced, or there can be no thunder. In passing an electric current through water and producing a bubble of detonating gas, the size of a pea, on ignition a report is heard like that of a pistol; so one can readily conceive what terrific reports would accompany the passage of the tremendous amounts of electricity or lightning through a cloud. A. It may be that some small quantity of water is separated into its oxygen and hydrogen when a flash of lightning passes through the moist air of a shower. But the quantity cannot be large in the short interval of time while the flash passes. It is possible also that a part of the heating effect of lightning may be due to the burning of this decomposed water We doubt whether the burning of the oxygen and hydrogen contributes very greatly to the detonation of the thunder. The usual explanation that the sound of the thunder is caused by the rupture and heating of the air, thus expanding it violently, with its immediate recoil and closing in upon the tube through which the electricity has just passed, seems to us to be quite sufficient. The air claps its hands, as it were, after the lightning forces them apart. The rumbling of the thunder, the prolongation of the sound, is believed to be due to reflections from the uneven surface of the earth and the clouds There is less rumbling of the thunder at sea, where the earth's surface is smoother There is most in the mountains We should accept the statement of the International Encyclopedia of 1903 as representing the usual view of scientific men. We would add that the familiar snap of the spark from an electric machine is only a tiny thunder clap, which is produced equally as loud and strong in air artificially dried, so that no decomposition of water is possible. As you have observed, there is no prolongation of the thunder when the flash occurs very near, since all parts of its path are at about the same distance from one's ear. The short snap is as really thunder as the prolonged rumbling sound.

(12694) P. N. J. asks for formulas for flashlight powders. A 1 Magnesium powder, 6 ounces, potassium chlorate, 12 ounces, antimony sulphide, 2 ounces. 75 to 150 grains of the powder should be used 2. Guncotton, 15 grains, and magnesium powder, 30 grains, are used. 3. Magnesium, 40 per cent, permanganate of potassium, 40 per cent, peroxide of barium, 20 per cent. 4. Purchase 1 ounce of magnesium powder and 1 ounce of negative guncotton from dealers in photographic materials. Place on a dustpan enough cotton, when pulled out, to measure about 3½ inches in diameter. Sprinkle it over with 20 grains of magnesium powder to form a thin, even film. Lay over the magnesium, thus arranged, a very thin layer of guncotton. Connect to the bunch of cotton a small fuse of twisted cotton about 6 inches long, so that it will extend to the side of the dustpan Then set the pan on a step ladder near the object, and, when ready, light the guncotton fuse with a match, when instantly a brilliant flash will ensue. There are several ready prepared magnesium compounds now sold, with special devices and lamps to fire them. 5. For photographing the interior of very large caves in such a manner as to bring out every possible detail, the following is recommended: Magnesium, in powder, 20 parts, barium nitrate, 30 parts; flower of sulphur, 4 parts; beef suet, 7 parts. Melt the suet, and add the other ingredients after having first mixed them by passing through a fine sieve. When thoroughly stirred in, pour the mass into zinc boxes of a suitable size. A box 3 inches in diameter and 4 inches deep will hold about 1 pound, and will give a flash of 20,000 candle-power. Such a flash, used in signaling in France, has been seen at a distance of 100 kilometers, or about 62 miles. 6. German patents have been granted on a series of slow combustion flashlight powders of the following composition: (a) Potassium permanganate, 30 parts; zinc filings, 10 parts: magnesium powder, 10 parts: iron, fine filings, to 100 parts. (b) Potassium nitrate, 30 parts; iron, fine filings, 60 parts; magnesium powder, 30

parts; aluminium powder, to 100 parts (c) Barium peroxide, 33.3 parts; magnesium powder, 33.3 parts; aluminium powder, 33.3 parts. When any of these powders is ignited it gives, at first, a reddish light, of low actinic value, the light gradually becomes more and more intense, until a maximum of actinic effect is reached. This slow combustion offers an advantage over the old rapidly acting flashlight powders, in that the eyes of sitters become gradually accustomed to the flash: hence the pictures do not present the staring eyes that are so offensive in the majority of flashlight photographs.

(12695) F. R. M. asks: I have heard many times that if a hot-water pipe and a cold-water pipe are equally exposed to freezing temperature, the hot-water pipe will freeze first. If this is so, what is the explanation? A. It is believed that the fact that the air has been separated from the water in the hot-water pipes causes these pipes to freeze sooner than the cold-water pipes.

(12696) B. N. K. asks how to make sheet wax. A. 1. Take of pure, clean wax, anywhere from 1 to 5 pounds, put in a tin bucket or any deep vessel, with clear water sufficient to fill it within 2½ inches of the top. Set on the stove till thoroughly melted, then set aside until partially cooled, skim all the air bubbles off. Then fill a smooth, straight bottle with ice water, a bucket of which you should have by you Soap the bottle, and dip it deliberately in the solution two or three times, according to the thickness you desire your wax. After the last dip, as soon as the wax hardens to whiteness, cut a line through it and remove it from the bottle as quickly as possible Spread to cool, and straighten out smooth while warm. Continue this process until all the wax is made into sheets. 2. Melt scrap wax in hot water, and add sulphuric acid, 30 minims to each pound of wax. Boil for 2 or 3 minutes. Cool, and remove impurities from base of cake; boil again, and add a few drops of turpentine. When the liquid ceases to foam the wax is ready for rolling into sheets Stretch wires of suitable thickness across a glass plate to form molds of desired size Wet a glass rolling pin, and coat with soapstone. Pour the melted wax into the molds and pass the roller firmly over the wires.

(12697) J. M. R. asks: Recently I heard the assertion made that it was a fact that people on one of the other planets had been seen by people on the earth and an attempt had been made to send a message to them, and that the best that could be told, that an attempt had been made by them to answer the message. I have never seen any account of this, and do not believe it to be true, but am writing to you to know the facts in the case. A. The only planet about which any suggestion has been made that we might signal to the inhabitants is the planet Mars. When this ruddy heavenly body is in its most favorable position, a space something less than 30 miles square could be seen with a telescope A few years ago an astronomer said that he saw tiny points on Mars brighter than the body of the planet The suggestion was immediately made in the newspapers that these were fires made by the Martians to attract our attention, and that we ought to answer them. Nothing has been done in that direction. Sir Robert Ball pointed out that "a flag to be used as a wigwag would need to be 300 miles long and 200 miles wide with a staff 500 miles long. If we would signal by a fire, and Lake Superior were filled with kerosene and set on fire, the resulting blaze might be discerned as a speck of light, but not sufficiently prominent to suggest that anything unusual was in progress. Such illustrative comparisons are not encouraging to those who would undertake to signal to the inhabitants of other worlds

(12698) B. J. C. asks how to soften horn. A. The bony core of the horn is first removed; the next process is to cut off with a saw the tip of the horn, that is, the whole of its solid part, which is used by cutlers for knife handles and sundry other purposes. The remainder of the horn is left entire, or is sawn across into lengths, according to the use to which it is destined. Next, it is immersed in boiling water for half an hour, by which it is softened, and while still hot is held in the flame of a coal or wood fire, taking care to bring the inside as well as the outside of the horn, if from an old animal, in contact with the blaze. It is kept there till it acquires the temperature of molten lead, or thereabout, and in consequence becomes very soft. In this state it is slit lengthwise by a strong pointed knife, like a pruning knife, and by means of two pairs of pincers, applied one to each edge of the slit, the cylinder is opened nearly flat. The degree of compression is regulated by the use to which the horn is afterward to be put When it is intended for leaves of lanterns, the pressure is to be sufficiently strong (in the language of the workmen) to break the grain, by which is meant separating in a slight degree the laminæ of which it is composed, so as to allow the round-pointed knife to be introduced between them, in order to effect a complete separation For combs, the plates of horn should be pressed as little as possible, so that the teeth may not split at the points They are shaped chiefly by means of rasps and scrapers of various forms, after having been roughed out by a hatchet or saw; the teeth are cut by a double saw fixed in a back, the two plates being set to different depths, so that the first cuts the teeth only half way down, and is followed by the other, which cuts the whole length, the teeth are then finished and pointed by triangular rasps. Horn for knife handles is sawn into blanks, slit, pared and partially shaped, then heated in water and pressed between dies. It is afterward scraped, buffed and polished.

NEW BOOKS, ETC.

HENDRICKS, COMMERCIAL REGISTER OF THE UNITED STATES FOR BUYERS AND SELLERS. New York, 1912. 4to.; 1575 pp.; Price, $10.

The twenty-first annual edition of "Hendricks' Register," as it is apt to be called for short, is larger and better than ever. The new plan, which was adopted last year, of giving each subject a number has been retained, making reference to the subjects from the index extremely easy. It would be hard to get along without this useful book, five copies of which are in constant use in our office. This book furnishes complete classified lists of manufacturers, for the benefit of those who want to buy, as well as for those who have something to sell. It covers very completely the architectural, engineering, electrical, mechanical, railroad, mining, manufacturing, and kindred trades and professions. The index alone covers 122 pages, which will give the reader some idea of the comprehensiveness of the book. The total number of classifications in the Register is over 50,000, each representing the manufacturer or dealer in some machine, tool, specialty, or material required in the architectural, engineering, mechanical, electrical, railroad, mine, and kindred industries. There are 325 pages of new matter, and the whole represents upward of 385,000 names and addresses. The trade names of all articles classified in the Register are included, as far as they can be secured, thus adding greatly to the value of the book. No business office is complete without this volume, which is as necessary as the telephone.

THE PRINTING ART. Vols. XVII, XVIII, XIX. Cambridge, Mass.: The University Press. 4 to 527 pp. average.

A few years ago a "printer" was about in the same category as a plumber or other master of a hand-trade. Now, however, a modern printer is regarded more as a professional man—a designer and clothier of business and other literature. The reasons for this renaissance are numerous. The ancient "rule-twisters" that made a billhead look like a typographical St. Bartholomew are no more, their lack of art died with them. The type foundries learned that the cost of lead and antimony was the same when cast in "Cheltenham" or "Caslon" or "Scotch" as when cast in some of the mid-Victorian typographical horrors. Lastly, but not least, a quiet force entered the field, and by means of the press itself sought to uplift this important field of endeavor and succeeded. We refer to *The Printing Art.* This charming periodical is an illustrated monthly magazine devoted to the graphic arts. The job is admirably done, and done with exquisite taste. It is indeed a clearing house of typographical excellence. No product of the "art preservative" is too humble to be considered. The business card, the menu, the catalogue, the fashion plate, the magazine, the exquisite privately printed book. Everything in design, paper and print is germane to the scope of this periodical, which occupies its niche so well. The bound volumes before us are a wonderland of beauty, with most illuminating text. The advertisements and covers are all bound in, as they should be. This monthly is found on the desks of many buyers of printed matter, and the shrewd business man when he selects a new printer is apt to look around the exhibition room—furtively perhaps—to see if the row of familiar green-backed volumes are there, or at least a pile of unbound copies. *The Printing Art* has been an immense power for good

WHERE TO LIVE ROUND LONDON: SOUTHERN SIDE. By W. H. Shrubsole, F.G.S. Edited by Prescott Row and Arthur Henry Anderson. London: The Homeland Association, Ltd. New York: F. Warne & Co. 16mo., 228 pp. Price, 40 cents.

The Homeland Association takes up interesting places in England, and publishes complete monographs on them and does them well No phase of the subject is omitted. The geological formation, water, climate, ways of communication, rents, hotels, schools, places of worship, recreation, etc., are all treated London itself does not offer many charms to the permanent resident except possibly those of the Park Lane class, but the beautiful suburbs, particularly to the south of London, and places farther afield offer ideal homes, and this book describes them. The many lovers of England (and the United States is filled with them) should welcome with enthusiasm this and every other volume issued by the Homeland Association. The book is well illustrated with engravings, which makes one homesick for the motherland, which can only be visited at long intervals and with the expenditure of much hard-earned time and money.

SOUTHERN ENGLAND, COAST AND COUNTRYSIDE. Kent, Sussex, Hants, Isle of Wight. London: The Homeland Association. New York: F. Warne & Co. 16mo.; 218 pp. Price, 40 cents net.

This book tells where to stay, what to see, where to live, what to do, where to educate children, where to play golf, and all the countless things which one wants to know when the doctor intimates that possibly a summer spent in southern England would give surcease from the boiler-shop activity of our American existence. It is a most fascinating little book, which should be prized by all who love their England. It belongs to a series of books which shows that it is not

necessary to leave Britain in order to spend holidays in pleasant and picturesque surroundings. The beauties of southern England are almost matchless, and this book furnishes an admirable key to all.

HANDBOOK OF SHOEMAKING. By William H. Dooley, Principal of the Lowell Industrial School. With 41 illustrations. 12mo.; cloth. Price, $1.50 net. Boston: Little, Brown & Co., 1912.

In the preface to this book Mr. Dooley tells us that in 1908 he was asked by the Lynn Commission on Industrial Education to make an investigation of European shoe schools and to assist the Commission in preparing a course of study for the proposed shoe school in the city of Lynn. A close investigation showed that there were several textbooks on shoemaking published in Europe, but that no general textbook on shoemaking had been issued in this country adapted to meet the needs of industrial trades and schools, or those who have just entered the rubber, shoe, and leather trades. This book has been written to meet this need. The author begins with the history of footwear, its adaptation in conformance to the anatomy of the foot, and its growth to the present industrial stage. Then he describes leathers, the various methods of tanning, the manufacture and repair of the different kinds of shoes, together with the allied industries of rubber footwear and kid glove manufacture. The result of the author's European trip is reflected in a comparison between European and American methods As might be expected, America is far in the lead It must be stated, however, that recently American shoe machinery has been introduced into Europe, with the result that European methods and products are fast changing for the better. The list of chapter headings is as follows: Fundamental Shoe Terms; Hides and Their Treatment, Processes of Tanning; the Anatomy of the Foot, How Shoe Styles are Made; Departments of a Shoe Factory, McKay and Turned Shoes; Old-fashioned Shoemaking and Repairing; Leather and Shoemaking Terms; Leather Products Manufacture; Rubber Shoe Manufacture and Terms; History of Footwear.

A POPULAR GUIDE TO MINERALS. By L. P. Gratacap, A.M. New York: D. Van Nostrand Company, 1912. 8vo.; 330 pp.; map in pocket book. Price, $3.

All who have ever visited the American Museum of Natural History and seen the arrangement of the minerals, must have wondered at the erudition of the curator, Prof. Gratacap. It has one of the best arranged mineralogical collections in the world, as well as being one of the best. Therefore, when Prof. Gratacap starts out to combine a popular guide to minerals and a description of the collection under his care, we have a happy combination. This is a scientific book of high order. Popular guides to minerals are legion, and their distinguishing quality is usually their looseness of statements. The present book, however, shows the hand of the experienced mineralogist, who is familiar not only with the theoretical part of the subject, but with the actual specimens as well. Prof. Gratacap's opportunities have been very exceptional for study, and he has not neglected them in any degree. The volume before us is a handsome piece of book making. It is filled with half-tone engravings, mostly from the Bement collection in the American Museum of Natural History The subjects which have been selected for illustration are excellent, and the plates do justice to the minerals as well as they can in monochrome There is an excellent example of color printing of a mineral—rhodonite—which is used as a frontispiece The book will be of great use to visitors to public cabinets of minerals, and for elementary teaching in mineralogy. There are four hundred text illustrations and seventy-four photographic plates There is also a map in a pocket in the cover of the book, which shows the distribution of minerals in the United States It is a happy addition to the literature of mineralogy

HANDBUCH FÜR HEER UND FLOTTE. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant z. D. Unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Vollständig in 108 Lieferungen reichillustrierten Textes mit farbigen Beilagen, Karten, Plänen, Gefechtsskizzen usw. Deutsches Verlagshaus Bong & Co. Preis jeder Lieferung 2 Mark = K. 2.40.

Installment No 48 brings to a close special Volume IX on "Wars." Generalfeldmarschall Dr. Freiherr von der Goltz discusses the Greek-Turkish war of 1897 His account is illuminating because it shows what are the events that lead two modern powers to engage in war. Other excellent articles in this installment are devoted to the part that the German troops played during the Boxer uprising of 1900 and 1901, and the German colonial wars in South Africa, between 1903 and 1907. To Americans, the account of the Spanish-American war of 1898 will be of interest. Naturally both American and Spanish ineptness are criticised. Other conflicts that are discussed in the installment deal with the Boer war of 1899-1902, the Somaliland campaign of 1901-1904 against the Mad Mullah, the Turkish disturbances of 1908-1911, and the Russian-Japanese war of 1904-1905. This last war is particularly interesting to the military student, because it was the last great conflict in which enormous armies were opposed to each other and in which important naval actions took place. Splendid military charts are to be found in the installment. An excellent index has been supplied by Rechnungsrat Schaffler, which renders it easy to use the volume for reference.

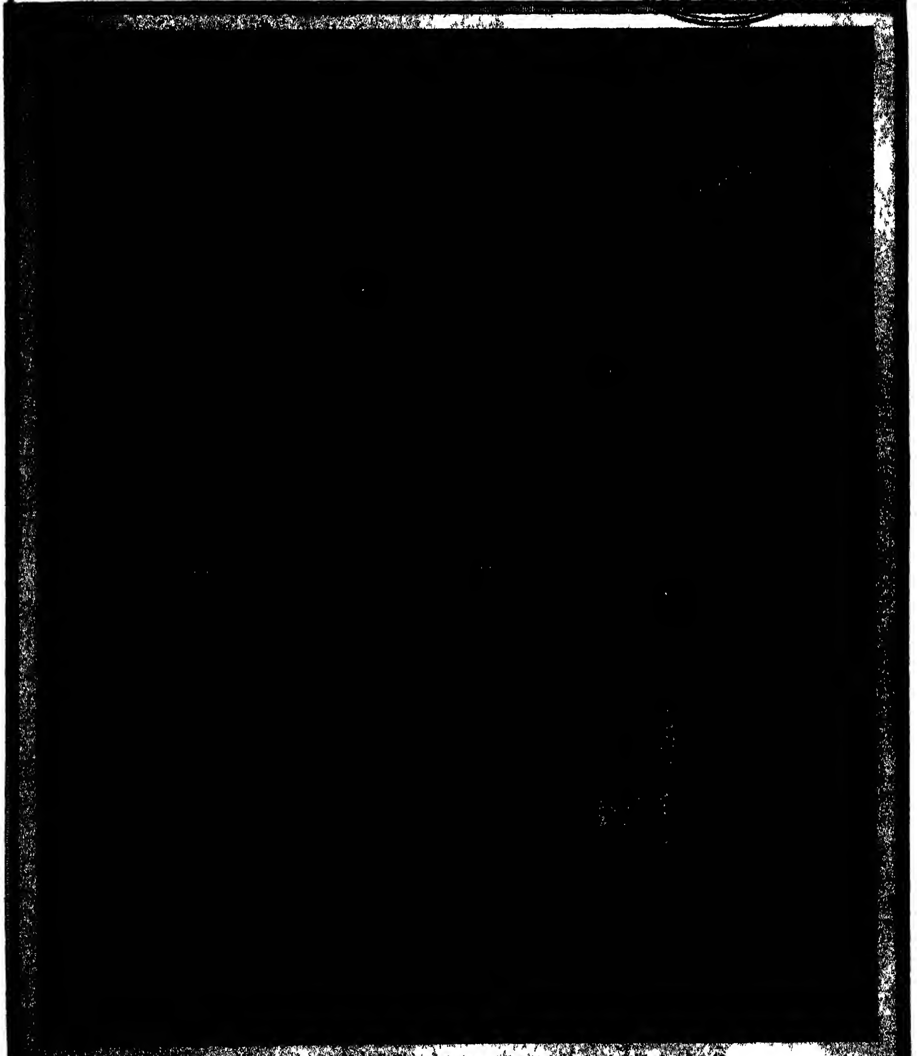
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII
NUMBER 20

NEW YORK, NOVEMBER 16, 1912

10 CENTS A COPY
$3.00 A YEAR



[illegible] gold from a large crucible [illegible]

[illegible] GOLD IS BOUGHT.—[See page 412.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 16, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid,	3.75

The Scientific American Publications

Scientific American (established 1845)	per year,	$3.00
Scientific American Supplement (established 1876)	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Peril of the Short Crossover

THE letter of the vice-president of the New York, New Haven and Hartford Railroad, which we publish on another page, calls to mind the story of the barrister who, on asking his solicitor for the brief, received the answer: "No case; attack the counsel for the plaintiff."

For, it so happens that our article "The Perils of the Short Crossover," which has bitten so deeply into the sensibilities of the New Haven Railroad as to suggest that it must have come very nigh the truth, was not written, as our correspondent suggests, by "a sapient critic, who doubtless derives his knowledge from some relative 'in the railroad business,'" but by that very Editor of the SCIENTIFIC AMERICAN to whom the letter is addressed, who, as it so happens, was formerly, for several years, a member of the engineering staff of one of our railroads, and who wrote the article referred to after consultation with several brother engineers of high standing, and after a careful personal examination of the scene of the wreck.

The New Haven Railroad, through its vice-president, complains that the writer did not follow "the accepted practise of reputable journals in previously submitting a proof" of the article "to the railroad company for criticism and comment."

Here is news indeed! We had always supposed (and still believe) that reputable journals, such, let us say, as *Engineering News* and the *Railway Age Gazette*, maintained their editorial columns on such a high plane of independent, judicial authority, that no corporation, be its power, influence, or patronage what it might, could swing their editorial pronouncements by one hair's breadth in this direction or in that. But if Mr. McHenry is to be believed, it is customary in technical journalism for the judge to submit his decisions to the defendant "for criticism and comment," before they are delivered and disclosed to the general public. If this be so, that public is to be congratulated on the fact that there is at least one technical journal which stands ready to investigate and point the lessons of a fatal disaster on a great railroad with the same independence and impartiality as it would those of the breakdown of an aeroplane or a motorboat.

We have approached this subject of the Westport disaster in a serious spirit and with a sense of the responsibility which the gravity of the accident demands. The letter of this official of the road is sarcastic and is couched in terms of levity which are strangely inconsistent with the serious relation in which the company stand in this matter, both to the public and to that admirable body, the Interstate Commerce Commission. Our articles advanced a theory in regard to the causes of the accident. Does this official of the railroad throw *any light* upon the subject; does he show any desire to expose the fallacy, if there be any, of the theory we have advanced? Rather, he resorts to ridicule and states that the diagram we published makes the outline of the swaying locomotive resemble a gyrating bronco. We have been serious in our efforts to discover the cause of this appalling accident. It is immaterial whether the diagram we published is suggestive of a bucking bronco or not; but it is very material to discover why the locomotive should have behaved like one. On this vital question the letter we publish maintains a significant silence.

As to the question of the higher speeds permissible on a number 20 crossover, as used on the Pennsylvania Railroad, we must ask our correspondent to believe that our information was derived from an official in the Engineer Department of that road, who outranks those quoted by Mr. McHenry. The speed limit of 35 miles per hour may be on the time cards; but if so, it is more honored in the breach than in the observance, as any person who travels between New York and Philadelphia can see on any day of the year. Disaster on a number 20 might arise from the failure of the rails and fastenings to stand up to their work, or from overturning due to centrifugal force. That the track would not fail is proved by the fact that the heavy engine passed at nearly 60 miles an hour through a number 10 crossover at Westport without leaving the least visible signs of undue stress that the writer could detect. That centrifugal force would not overturn a train at 60 miles an hour or over on a number 20, where the thrust would be only about one fourth as great, may be proved by a simple calculation with pencil and pad.

We are very glad to learn that the New Haven road has been lengthening some of its crossovers. This was urged by the SCIENTIFIC AMERICAN as an absolute necessity after the accident at Bridgeport, some fifteen months ago. The question, however, is not one of the general policy of the road elsewhere on its lines. What the SCIENTIFIC AMERICAN has asked, and still asks, is: Why, in view of the accident of the year before on a number 10 crossover at Bridgeport, did not the New Haven road spend the few hundred dollars necessary to change that crossover to a number 15 or 20, and why did they leave in their tracks, a few miles away at Westport, no less than three similar crossovers, on one of which the recent disaster occurred?

We are greatly interested to learn that in the present case there was a distant signal set at "caution"—that a conductor, a towerman, a section foreman, a home signal set at "danger," and a dwarf signal, failed in their combined efforts to arrest the speed of the train—for it all goes to prove the strength of our contention that the mere laying down of rules of speed will not effectively safeguard a train against inherently perilous crossovers, and that it is the duty of a railroad, therefore, to eliminate from its tracks, as far as it can, all possibilities of disaster due to disobedience of orders or to the physical failure of the engineer of the train. The fact that the railroad exhausted every possible means of appeal to the intelligence of the engineer simply accentuates the argument that risks due to human fallibility should be reduced to a minimum by making the layout of the tracks, as far as is economically possible, "foolproof."

Regarding the latter part of the letter, which does not concern directly the plea in our issue of October 26th, we have this statement to make: The SCIENTIFIC AMERICAN is not in sympathy with legislation, which, in some parts of the country, has been directed against the railroads, simply because they are rich. It is not in sympathy with drastic emotional legislation aimed at the railroads for political effect. We are aware of the fact that the railroads have fared badly at the hands of certain demagogues, and that in some cases they have not obtained just treatment. The SCIENTIFIC AMERICAN admired, beyond measure, the courage of the Governor of New Jersey, now the President-elect of the United States, when he vetoed a bill during the past year, which he considered imposed an unreasonable and unjust burden upon the railroads passing through that State. The SCIENTIFIC AMERICAN stands for justice and fair play on the part of the political parties toward the railroads; but at the same time it demands that the railroads shall secure to the public the highest possible safety of travel. When a railroad fails in this respect, it shall be the self-imposed task of this paper to try, honestly and impartially, to ascertain the reasons; to point out the lessons of such accidents as that at Westport, and to suggest the proper remedies. The bucking of that bronco of a locomotive—to use the felicitious phraseology of our correspondent—on a number 10 crossover was no wanton act. When it left the tracks it did so in obedience to the inexorable laws of centrifugal force. It is for the proper authorities to determine how and why it became possible for those laws to be so disastrously defied, and to enforce such changes in track construction that any repetition of the Bridgeport and Westport disasters may be rendered *physically* impossible.

In conclusion and in proof of our impartial attitude in this discussion, we wish to state our conviction that the four-track system of the New Haven Railroad between Woodlawn and Bridgeport is one of the finest stretches of road in the world. With its 100-pound rail, its tie-plates on every tie associated with *screw* bolts in place of the archaic spike, and its deep bed of broken-stone ballast, it presents an example of absolutely first-class construction that is a delight to the eye of the engineer. By the very measure of that excellence does the presence of these abominable short crossovers, with their eternal menace to the safety of the fast traffic, appeal to the engineer as a blot upon an otherwise exceedingly fine example of high-class American railroad construction?

[illegible]

TRUE science is perforce both sane and [illegible]tarian; and her votaries have ever [illegible] objects in view, which they seek by [illegible] and practical means. There have been instances [illegible] doings assumed to be scientific that would hardly [illegible] these specifications, but which have a jocund int[illegible] and may besides possibly have instructive point.

An illustrious nature lover (and not a nature f[illegible] by any means) becoming interested in the ques[illegible] "Why does a mosquito refuse to touch a frog?" [illegible] perhaps with an ultimate view to the elimination [illegible] both these pests, rightly concluded no fair ans[illegible] could be given the question until it was determi[illegible] if the mosquito does really make this blessed ex[illegible]tion. So the experimenter repaired after nightfall [illegible] a marsh, where he held up a frog in the presence [illegible] the mosquito host. His hand was most grievously [illegible]ten, while the frog had never the slightest occas[illegible] to scratch himself. One is here reminded of [illegible] Hibernian gentleman who held his dog all night in [illegible] snow to freeze it. It seems never to have occurred [illegible] our nature lover to have saved himself those dreadf[illegible] stings by wearing a glove stout enough to be impermeable even to mosquitoes. Nor for all his pains did he prove anything worth while. For whether mosquitoes sting frogs or no, the two genera have from time immemorial been known to flourish in the same sort of place. There seems to be an amicable relationship, a sort of business understanding between them, the mutual object being the vexation of humankind. True, frogs are supposed to eat mosquitoes; but this seems to be done genially and without heat, after the fashion of the companionable walrus in "Alice in Wonderland," who after dancing with the oysters, tearfully devoured them. And yet the alleged proclivity on the part of frogs, to eat mosquitoes, seems not to have diminished the visible and working supply of the latter. Their joint presence in marshes has been so detrimental to nocturnal comfort and to the value of nearby real estate that something ought certainly be done—something rational, however. These creatures are both musically inclined and presumably they enjoy each other's songs—a penchant not generally shared by their human neighbors; and yet after some persons we have heard sing, we should rather, if we had to make a choice, decide not unfavorably to the marsh denizens. Be all this as it may, the only rational purpose of any experimentation in the premises would be the elimination of the mosquito and the frog; and there is no other way to achieve this than to drain the marshes.

Another "scientific gent," a resident of the cactus belt, was some time ago (possibly still is) zealous for the formation of a cult of cactus eaters. The spineless cactus of lower California has been his favorite food; he has been eating it, drinking concoctions of it, taking it in soup and omelette and salad; and he gained weight in the fortnight when he lived exclusively on cactus. Nevertheless he has, no doubt, long before this, found the habit an absurdly expensive one; and any cactus-eating cult, unless it be made up of millionaires, must inevitably die out for the monetary reason alone.

It was some time ago reported that a fellow-citizen has made a will consigning his body, after his death, to various mechanical uses. Buttons are to be made of his bones; leather bags of his skin; fiddlestrings of some of his more intimate internal relations. This gentleman proclaimed himself a utilitarian, determined to practice his creed to the very death. Yet his philosophy is really not utilitarian. For the bone button market is now so well supplied, these articles sometimes get into places where they certainly have no business—into soup, for a horrible example. And there is no dearth of fiddlestrings—more's the pity. And what normal individual would care to buy and have about him bags made of human skin—and this in an era when felines and canines, whose pelts would make much better bags, are so prolific and can be had so reasonably as to expense. In point of fact, it would cost more to transfer the mortal remains of this pseudo-utilitarian into merchandise than the product would bring in the open market.

The Hardened Copper of the Ancients

IT is commonly supposed that the ancients succeeded in hardening copper. Metallurgists who have examined specimens of this so-called hardened copper have found that it is not pure copper, but usually an alloy of copper, either natural (that is, the two metals existed in one ore, so that in the process of reduction an alloy was formed) or an artificial alloy made by melting two ores together, the one copper and the other zinc. The so-called Monel metal, now a regular product of an eastern copper refinery, is the modern equivalent of the ancient natural alloy—a compound of copper and nickel obtained by reducing the copper-nickel ores of the Sudbury mines in Ontario. All the arrowheads and other implements which have been found in the Sudbury district are made of this native copper-nickel, hardened only by hammering.

Electricity

Delay in Traffic on an Electrified Railway.—The delay by troubles in electrical apparatus last year in the thirty-three electric locomotives operating in the New York terminal district of the Pennsylvania Railroad amounted to only 13 minutes. The total mileage run of these locomotives was 900,000, including a mileage of 00 for a single one of the locomotives.

Telephony at a High Altitude.—The highest telephone station in the world, according to a German paper, is in the meteorological observatory on the top of Mont Rosa in the Pennine Alps, 15,450 feet above sea level. At this elevation snow is always found, and advantage is taken of the high insulation given by dry snow, the wires in the last section, at the peak, being simply laid on the snow-covered ground. To prevent breakage by glacier movements the line is carried through s on the telephone poles. The poles are very short and are taken down at the end of every summer season and replaced at the beginning of the following summer.

Electric Power for the St. Gothard Tunnel.—According to Dr. Kummer's calculations for the amount of power which is needed to operate the St. Gothard line and tunnel on the electric system, the total cost for the power-plant work will be $14,000,000, and the current is obtained from the Göschenen, Amalig and Ritom hydraulic plants. It is proposed to operate separately the sections lying north and south of the tunnel. About 30,000 horse-power is needed on the north side and 37,000 on the south. The above hydraulic plants could be called upon for 95,000 horse-power. The electric line will be best operated on the 15,000-volt alternating current system.

Running a Railroad with Wireless Time Signals.—At the St. Quentin station on the Northern' Railroad in France there has been installed a wireless telegraph station for receiving time signals from the Eiffel Tower station so as to have the exact time and thus be able to set the station clocks more accurately than before. The distance from Paris is about 95 miles, so that the time signals are well received even with the small aerial used. No doubt the railroad will extend the use of the wireless method in the future. A station which is so equipped can also send the time over the ordinary telegraph lines to other railroad stations.

Electric Heat for Shrinking on Wheel Rims.—Although the cost of electricity for heating is generally higher than the cost of fuel to accomplish the object by ordinary methods, electric heating for special mechanical purposes often shows a distinct operating economy due to the saving of time attained by its use. An instance is an electric heater for shrinking on wheel rims, consisting of a built-up iron ring with grooves containing a heating coil traversed by an alternating current and adapted to be laid in contact with the rim that is to be shrunk on. The heating is rapid, and it is found that the expansion of the rim continues after the current is switched off in the heater, allowing time for the wheel body to be got ready for insertion in the rim. As compared with a gas fire, two or three times as many rims can be shrunk on in a given time by this appliance.

Conservation of Heat Energy in the Coal Pile.—Electrical engineering is constantly at work seeking to transform the largest possible percentage of the total available heat energy in coal into electrical energy, and to this end has endeavored to improve the efficiency of steam engines, steam turbines and internal combustion engines. Another way to conserve the heat energy of the coal used under the steam boiler is to protect this fuel from deterioration of the value that it has when purchased, that is, from the loss of heat units, during long storage, by exposure to the air and also by spontaneous firing of coals containing sulphur. An Indianapolis electric light company has devised an under-water coal storage pit containing 25,000 tons, of which 15,000 tons can be submerged. This pit, which represents an investment of $20,000, will be filled by gravity, thereby limiting the cost of handling the coal to one transfer.

Electricity on Italian Railroads.—Some important changes are being made on the Milan-Gallarate-Portoceresio electric railroad in the north of Italy. This line was one of the first to be installed in the country, and it is now on the point of adopting modern methods. The old steam plant of Tornavento, which was expensive to work and is now too small, will be shut down, and the current for the road will come from the large hydraulic plant of Varzo on the south side of the Simplon. Current at 45,000 volts is brought to Gallarate by a power line running along the railroad, and the current for the cars is supplied by seven substations spaced along the line, instead of the four stations which were formerly used. Owing to the increased amount of power which the railroad now has at its disposal, it is able to run heavier passenger trains than before and also does away with the use of steam locomotives on the freight trains. For the heavy passenger traffic there are used five large electric locomotives of 2,600 horse-power. At the hours of light traffic the trains will be made up of a few motor cars according to the usual method.

Science

New Heat-resisting Glass.—While the new variety of glass known as quartz or acid glass is valuable from the fact that it resists heat and does not crack when suddenly heated and cooled, so that various apparatus can be made of it, such glass has a tendency to crystallize when heated for a long time near the melting point. This makes the glass mechanically weaker and it changes more with heat. A new glass made by M. Thomas does not become de-vitrified in this way, and he obtains it by using silica to which is added a small amount of certain metallic oxides, these being acid oxides, especially zirconium or titanium oxides. As small an amount as 0.1 per cent is enough to increase the mechanical resistance by 20 to 50 per cent, and the general properties are much superior. He considers that the glass contains a colloid solution of the oxides, so as to hinder crystallization.

Corrosion of Aluminium Kitchen Utensils.—Sheet aluminium is now frequently used for making kitchen utensils and the like, but these are noticed to become corroded without actual usage, as for instance when kept in stores. Tests made in Germany on the subject are intended to show the condition of the rusting or rather efflorescence on the metal, this being produced by oxidation. When the coat is removed, the metal is seen to be more or less deeply scored. Analysis shows that the coating contains aluminium, lime, silica and magnesia. Sheet aluminium was exposed to the action of distilled water or ordinary water, and this gave a more or less rapid attack. This was less rapid when the plates were placed in air and water in turn, but surface oxidation also occurred. It appears that the water must contain oxygen in order to attack the metal. The effect increases with the heat and also in the presence of carbonic acid.

Travelling and Exploring in Siberia by foreign men of science, although not prohibited by the Russian government, entails a good deal of preliminary red tape, according to information on this subject furnished by the American consul at Vladivostok. Permission should be requested through the embassy at St. Petersburg several months in advance. The number and kind of guns that one desires to bring must be specified, as the importation of firearms into Russia without special permit is contrary to law. Visits of foreigners to coastal Siberia are not looked upon with favor by the authorities. The sportsman is reminded that the hunting of sable has been prohibited throughout Siberia and the Russian Far East for three years beginning February 14th, 1913. The best plan is to make trips under the auspices of some well-known scientific body, rather than on one's own responsibility.

Changes on Jupiter.—During the greater part of the 1912 apparition of Jupiter the northern equatorial belt of the planet has been abnormally faint as though partially obscured by a film of vapor. On August 23rd a dark spot was observed in the region of this belt, approximately in longitude 215 degrees. The disturbance seemed to increase rapidly, apparently spreading in the direction of the rotation of Jupiter, and its mean rate of motion has been greater than required for system I, though the disturbance seems to be chiefly in the latitudes of system II. Its progress was such that by October 7th the disturbance extended more than 287 degrees around the disk of the planet. A few days prior to October 5th the preceding part of the area had made a complete circuit around Jupiter and from recent observations the whole northern equatorial belt has apparently been cleared of the white matter which obscured it. This belt is at present a conspicuous feature of the planet. The appearance of intensely dark condensations and the rapid proper motion of the disturbance have indicated that the manner in which the belt reformed was somewhat spectacular.

Surveying the Congo Region.—The use of modern methods for laying out frontier lines in the colonies is well brought out in the work which is being done in the Congo region. According to a recent treaty, France ceded a certain amount of territory in Africa to Germany in exchange for concessions in Morocco, so that this led to expeditions on the part of both countries in order to fix the boundary lines. Capt. Periquet states that wireless telegraphy will be used for the first time on a large scale so as to determine latitudes exactly. Wireless stations now exist in the French possessions, also in Cameroon and Belgian Congo, and all these are to be utilized by the expeditions. They will carry improved kites for mounting the antenna wires, also the necessary wireless posts. For taking the latitude they use prism astrolabes which give very close results. These measurements will be combined with plans drawn up on the spot by the alidade, this latter being used especially for the important points. Once in possession of the data, they will draw up a map of the frontier region on as large a scale as possible. Other scientific work will be done at the same time, which is likely to be valuable, such as hydrography, orography, questions of population, botanical and ethnological research, terrestrial magnetism and the like.

Aeronautics

An Aerostructural Balance.—For automatically balancing an aerostructure, Roy M. Palmer of Washington, D. C., in a patent, No. 1,039,181, presents in connection with ailerons a shifting fluid column and an electrically operated means connected to the ailerons and having a series of superimposed electro-magnets, the shifting of the fluid column operating to energize the electrically operated means to shift the ailerons to various inclinations. An arrangement is also provided to maintain the ailerons at the proper point when the fluid column returns to normal position.

Paris Aero Show.—The fourth aeronautic show to be held in Paris was opened on the 26th ult. by President Fallières, assisted by the Ministers of War and of the Marine. Sixty of the latest aeroplanes are on exhibition, while but two balloons and no airships are to be seen. The show is given up almost entirely to military aeroplanes and hydro-aeroplanes for the use of the navy. The chief of the latter is the Astra biplane which won the St Malo meeting This machine is made entirely of metal and the float at the rear end of the fuselage forms a rudder so that the hydro-aeroplane can be steered when running on the water. The exhibition of aeronautic motors is a large one, the most noteworthy of these being the 400 horse-power motor of the Astra-Torres dirigible for Great Britain The War Department, besides showing aeroplanes and their component parts, has on exhibition the automobiles used for transporting such machines and repairing them. Sailors have charge of the Government hydro-aeroplane exhibit. The SCIENTIFIC AMERICAN hopes to publish soon an article, illustrated by photographs, of the principal exhibits at the Show, an article that will critically point out what is good and what is bad.

Fatal Balloon Accident in Germany.—While trying out his new balloon preliminary to the Gordon Bennett race, on October 20th, Lieut. Hans Gericke, the well-known German aeronaut and the winner of the Bennett race last year, fell to his death with his aide as a result of his balloon bursting when at a height of about 3 miles. Lieut. Gericke, soon after he started out and while at an elevation of about 6,000 feet, approached a thunder shower and was caught by a sudden upward current which carried the balloon to a height of 15,000 feet in a very short period of time. Either on account of the rapid expansion of the gas, or because it was struck by lightning, the balloon burst and the two men fell to their deaths at a terrific speed. This accident proves that no matter how experienced the pilot or how well-built the balloon, there is an element of danger in ballooning that is not met with by the heavier-than-air machines. It would seem that ballonists should be equipped with a safety parachute, such as has recently been invented by A Leo Stevens, so that in case of such an accident, they could jump out of the basket and descend safely to earth.

New Records with Model Aeroplanes in America.—As mentioned in a recent issue of the SCIENTIFIC AMERICAN, a number of new model aeroplane records were made at the Aeronautical Society's exhibition on Staten Island, on October 12th The chief of these was a duration record for monoplanes launched from the hand of 158 4/5 seconds made by Armour Selley of the New York Model Aeroplane Club Young Selley's model soared 40 feet high and traversed a distance of over 2,000 feet before alighting. The best previous record, made in England, was only 1,431 feet, though Selley's model flew 2,653 feet at Mineola last summer The American duration record for a flight from the hand 91 2/5 seconds—was broken four times on Columbus Day, it being raised respectively to 92 1/5 and 96 2/5 seconds, 119 2/5 seconds and 158 4/5 seconds. The record-holder is young Selley, who, with a model 40 inches long, fitted with but fourteen strands of 1/8-inch wide, flat rubber bands, made a remarkable flight of 2 minutes, 38 4/5 seconds duration, thus breaking by 55 4/5 seconds the world's official duration record In the competition for monoplanes over 4 feet long, starting from the ground, George A. Page, Jr., of Hillsdale, N. J., made a new world's record of 585 feet In a similar competition for models under 4 feet in length, H. Schultz won the first prize by a flight of 726 feet At a second meet, held on Election Day, Selley's model, resting on skids and starting from the ground, flew 1,408 feet, while George A. Kavanah's flew 1,400 feet The best record of this kind—1,184 feet—was made by Dr Dedderer some time ago. Selley's record-breaking model, and in fact most of the models used this year, are monoplanes with a small guiding surface far out in front on a triangular (in plan) fuselage, the distinctive feature of the American models being that they all use propellers at the rear instead of tractor screws. A tremendous advance has been made by American boys during the past year in the construction of model aeroplanes, and it is wonderful indeed to find that a good sized model can be propelled half a mile through the air by means of a few elastic bands.

Launching Ships by Trigger

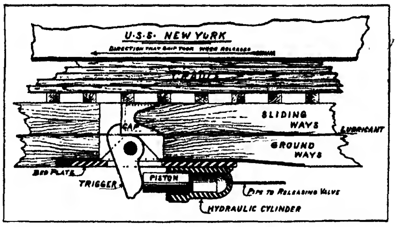
IN the launch of the battleship "New York" recently at the New York Navy Yard, Brooklyn, a departure was made, for the first time at this yard, from the time-honored method of releasing a ship by sawing through the timbers which prevent its movement down the ways.

The work of launching the ship with all the careful preliminary preparations was done under the immediate supervision of the chief naval constructor of the yard, Robert Stocker, who was responsible also for the building of the "New York," the immediate oversight of which was delegated, as we stated in our article at the time of the launch, to Naval Constructor John E. Bailey.

The "ways," which play such an important part in the launching of a ship, are of two kinds: the ground ways and the sliding ways. The former are permanent and immovable; the latter are temporary and move with the ship into the water. The ground ways consist of two lines of heavy longitudinal timbers, one on each side of the keel of the ship, placed about midway between the keel and the turn of the bilge. They are laid upon lines of piling, which are driven down to a firm bearing, with a carrying capacity sufficient to hold up the ground ways firmly in place, and insure them against any settlement under the great load of the ship. Laid immediately upon the ground ways are two similar lines of longitudinal timbers which constitute the sliding ways. Between the faces of the two ways is placed, for purposes of lubrication, a heavy coating of grease.

The launching weight of the "New York" was 10,000 tons, and the inclination of the ways resulted in a heavy thrust which had to be resisted until the moment arrived for letting go the ship. Under the old method of launching, the sliding ways were locked to the ground ways by two heavy balks of timber. In launching, cross-cut saws were used to cut through these timbers and so release the ship.

Under the new method, as shown in our illustration, a massive steel trigger is pivoted in the ground ways, and in its normal position engages a cap set in the sliding ways. It is maintained in place by a hydraulic piston. When the signal is given to release the ship, a releasing valve is turned, and the glycerin in the hydraulic cylinder is allowed to escape. The pressure in the cylinder being removed, the trigger swings on its pivot, disengaging the cap, and allowing the ship with its cradle and sliding ways to move down into the water.



The hydraulic trigger used in launching the battleship "New York."

A Forty-mile-an-hour Dreadnought

By F. C. Coleman

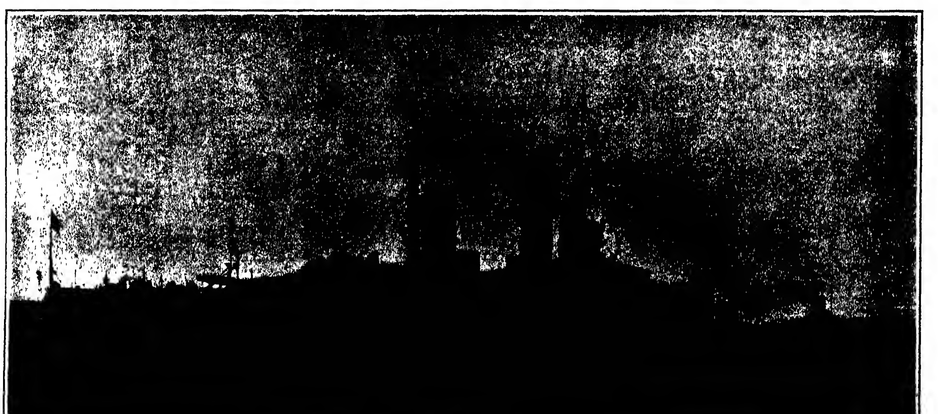
THE British battle-cruiser "Princess Royal," constructed and completely equipped for service at the Naval Construction Works, Barrow-in-Furness, England, in covering a measured mile during her trials at 34.7 knots has established a world's record for vessels of her class. She is 660 feet long between perpendiculars, 88 feet 6 inches beam, and, with a draft of 28 feet, has a displacement of 26,350 tons. Like H. M. S. "Lion," she is the largest cruiser yet built for the British Navy, and is also the broadest, excelling even the "Lusitania" and "Mauretania." The eight 13.5-inch guns in the "Princess Royal," as in the "Lion," are much more effectively disposed than in the earlier armored cruisers. Forward there are in the center line two twin-gun turrets, the one to the rear being at a higher elevation, so that its guns fire over the turret in front. Amidships in the center line there is one twin-gun turret, and aft there is another. Thus all eight guns fire on either broadside. Four fire directly ahead, but by giving a slight angle of helm the ship may alter her course sufficiently to enable all eight guns to be utilized in chasing the enemy. In the "Conqueror," which belongs to the "Orion" class, there are ten 13.5-inch guns, arranged two pairs forward and two pairs aft, the rear pair in each case being at a higher level than those immediately in front. The remaining turret is in the center line amidships. There are in both the "Princess Royal" and the "Conqueror," sixteen 4-inch breech-loading guns for repelling torpedo-boat attack; these are located on the superstructure deck. In the matter of armor protection something had necessarily to be forfeited in the case of the "Princess Royal," in order to insure the exceptionally high speed required by the tactician. This is, perhaps, the only point, with the exception of the omission of two of the primary guns, which differentiates the two types—the battleship and the armored cruiser. As in all warships, there are three tiers or strakes of armor-plating. While the thickness of the water-line strake in a battleship is 12 inches, the remainder of the upper deck being 9 inches or 8 inches, the "Lion" has, for the water-line and for the strakes above it, 9 inches of armor. The gun positions are also well protected. Forward and aft the thickness of the broadside armor is reduced by gradual stages to 4 inches. It will thus be seen that the "Princess Royal," notwithstanding her exceptionally high speed, has armor which is superior in its resistance to perforation by modern guns to that of pre-dreadnoughts; in fact, with their legend [illegible] 28 knots, as compared with the 17 and 18 knots [illegible] earlier ships, the "Lion and the "Princess Royal," as well as the "Queen Mary," now being built by [illegible]. Palmers at Jarrow-on-Tyne, could steam round [illegible] of pre-dreadnoughts and fire when it suited them, [illegible]ing beyond the range which would enable the old battleship guns to penetrate the armor of the modern cruiser. It is often said, of course, that personnel must necessarily be considered, but it is reasonable to assume that the efficiency would be of as high a standard in the new ships as in the old, especially as in the former there is superior gun-control and sighting mechanisms, which will insure greater accuracy in service. The principal steam trials included a 24 hours' run at two thirds the total power, and an 8 hours' run at full power. Both tests were of course, carried out at the service draft and under limiting conditions as to air pressure in the stokehold. The coal consumption on the 24 hours' trial was 1.16 pound per shaft horse-power per hour for all purposes. The power of the 8 hours' run exceeded that required by the contract, and the speed was also considerably in excess of the designed rate, notwithstanding that no attempt was made on the official trial to test the maximum steaming capacity of the boilers.

The "Princess Royal" and the "Lion," being alike both in respect to the form of hull and the propelling machinery, the British Admiralty ordered at the outset two sets of propellers for the "Lion" and two sets for the "Princess Royal." The "Lion" carried out duplicate tests with the respective propellers, and the second set was fitted to the "Princess Royal," and she carried out the measured-mile trials, corresponding exactly to those run by the "Lion" with the different sets of propellers. The results of all four sets of trials will enable the Admiralty to determine the most suitable dimensions of screw propellers for this type of ship, and these will be utilized in both vessels.

Upon her full power trials, off Plymouth, the "Princess Royal" attained the high speed for a vessel of her class of 32 knots. But that was not the best she could do. On her return, she was dry-docked at Devonport and her propellers were changed. She coaled and went out again for six runs at three fourths and then at full power on the Polperro measured mile. On the last-mentioned occasion, it is authoritatively stated that she reached a speed of no less than 34.7 knots and made an average of 33 knots, which establishes a world's record for vessels of her class. It may be recalled that the original maximum speed of the "Lion" was 29 knots, but that she subsequently made 31.7 knots.

International Show at St. Petersburg

THE Imperial Russian Automobile Club is organizing its fourth international automobile show, to be held at St. Petersburg next spring. The show is to last fifteen days. The opening date is not as yet fixed, but will probably be between April 17th and May 7th.


The 34.7-knot battle-cruiser "Princess Royal."

Length, 660 feet. **Beam**, 88 feet 6 inches **Displacement**, 26,350 tons. **Speed**: Average of six runs on measured mile, 33 knots; maximum run, 34.7 knots. **Armament**: Eight 13.5-inch guns. **Armor**: Belt, 9 inches; gun positions, 9 inches.

Receiving a deposit of gold.

Weighing gold on assay balances.

How Gold is Bought

The Methods of the United States Assay Office

By Jesse Simmons

SUPPOSE that you owned a gold mine. What would you do with the gold? In the ordinary commercial lines the marketing of the product depends upon ability to place it before the people, and involves the meeting of competition, adjustment of freight rates and the surmounting of numerous little difficulties, all of which have a bearing upon the ultimate result of your undertaking. With gold it is different. Uncle Sam stands ready to buy all of the gold brought to his mints or assay offices.

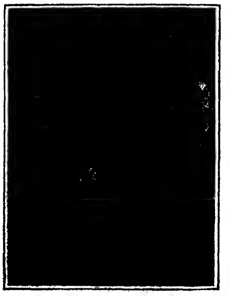
There are three coinage mints where you would be able to dispose of your bullion, viz., Philadelphia, Denver, and San Francisco. Should it happen that your mine was not located convenient to any of these mints, you would find United States assay offices at Boise, Idaho; Carson, Nevada; Charlotte, North Carolina; Deadwood, South Dakota; Helena, Montana; New Orleans, Louisiana; New York city; Salt Lake, Utah; and Seattle, Washington. At these institutions gold bullion is purchased and forwarded to the mints.

You would take your gold into the office and watch it weighed upon a pair of balances so sensitive that although they had several hundred pounds in each pan, one one-hundredth of an ounce would be indicated. Having weighed your gold, the officials would issue you a receipt for it which you would keep until you received your check or coin in payment. Your gold would then have become what is known in the office as a "deposit." This deposit, with many others like it, would be turned over to the melting department, where, in a specially constructed furnace, it would be melted in a plumbago crucible with the proper fluxes and poured into a suitable mold. Simple as this may sound, the melting of gold is a very serious and difficult task. The high heat which it is necessary to generate in order to melt the metal necessitates a furnace constructed of the most refractory material. These furnaces are usually operated by gas or oil and are built of the very finest grade of fire brick and fire clay. The plumbago crucible which is used is composed of graphite (the same material that comprises the center of your lead pencil), a little fire clay and a little sand. In the manufacture of these crucibles great care must be taken to secure a uniform mixture of the component parts, so that when heated no portion of the vessel will expand more than any other portion. Unequal expansion would cause cracking.

The crucibles are fashioned in molds and dried, or burned in kilns, after a fashion similar to dishes or bricks. They are made in all sizes from those having the capacity of an after-dinner coffee cup to immense sizes holding over twelve gallons. Before melting gold in one of these crucibles it is necessary that it be very carefully annealed, which means that the last possible traces of moisture must be expelled by slowly increasing the temperature for several days. This is done by placing the crucibles in a steam-heated oven, where the process is carried forward until it is deemed that the vessel is in suitable shape to be placed in the fire. Covers and stirrers are made of the same material as the crucible. The latter are used to stir the gold in the crucible after it is melted. Covers and stirrers pass through the same annealing process as the crucibles, although it is not necessary to take so much care with them.

Weighing the bars of bullion.

Boring a bar for samples.



Removing assays from cupel furnace.

Removing gold assays from boiling apparatus.

Gold coming direct from a mine is never pure. It may contain various base metals, the nature of which depends upon the process by which the gold was won from its matrix. Gold from stamp mills contains some iron, very likely some copper and often some quicksilver. From cyanide mills the bullion nearly always contains zinc, as this metal is made use of in the process. The zinc, too, may also have contained impurities, some of which will very likely be in tho resulting bullion. Copper has some of the characteristics of gold, both physical and chemical, so that if copper is contained in the original ore some of it will be very likely contained in the bullion. Silver is always associated with gold in the ores of the latter. The amounts may vary greotly, but it may bo stated that silver is always present in gold ores.

The problem of the melter who handles the deposits at the assay office is to make from the deposit a bar of bullion which will be homogeneous, or in other words, a perfect mixture from top to bottom and from end to end of the gold and other metals. In order to do this he places in the crucible with the deposit a stated amount of flux, varying with the size and composition of the deposit. The virtue of this flux is to remove a certain portion of the base metals and likewise to form a molten mass over the top of the bullion which will prevent volatilization of the precious metals. It is lighter in specific gravity that the metal and rises to the surface of the melt. For clean bullion the flux is composed usually of borax. Perhaps some little soda will be added. For bars which contain five or ten per cent or more of the base metals the flux will be comprised more largely of soda. This is just the ordinary soda which the housewife uses in collaboration with sour milk to make biscuits or other dainties. Niter is also used on bars containing large amounts of impurities.

Having placed the deposit in its crucible in the furnace, with the necessary fluxes, the heat is applied and the metal and flux melted in thirty to forty-five minutes. The melter puts on an immense pair of asbestos mitts to protect his hands from the intense heat and removes the cover of the furnace, the cover of the crucible, and taking the stirrer in a pair of iron tongs, he carefully stirs the entire content of the crucible. The stirrer was placed in the furnace at the time the crucible and charge were admitted, and is of the same temperature as the

HOW GOLD IS BOUGHT

other contents. On very dirty or impure bars this stirring may be done two or three times, the furnace being closed in order that the heat be brought up to the required point after each stirring. The molds into which the gold is poured are made of iron and a full stock of the various sizes is kept on hand so that no matter what the size of the deposit a bar will be turned out with a width approximately twice its depth and a length about twice the width. Into this receptacle the melter pours the contents of the crucible. The metal sinks to the bottom, and the slag, as the flux is known after it has passed through the process, rises to the top. After the metal and slag have solidified the mold is overturned, the slag separated from the bar, the bar cleaned and weighed. In order that the depositor may receive pay for every bit of gold which properly belongs to him, the inside of the crucible is scraped clean and the slag treated by being crushed to powder and panned in a miner's gold pan. The problem of the melter, then, it will be seen, is to add the proper flux, to see that the furnace produces the high heat which is necessary in order to successfully melt the charge, to have his crucibles in such shape that they will not break in the furnace when subjected to the high heat and to dexterously pour the bullion into the mold and recover the values from the slag.

The weight of the granules which have been recovered from the slag is added to the weight of the bar and this amount is the weight of bullion for which the depositor is paid. It is then the assayer's business to determine the proportions of gold, silver and base metal in the bar. These proportions are reported in thousandths. He obtains a sample by means of a special clipping machine designed for the purpose.

A complicated chemical process is necessary to determine the fineness of this sample. It cannot be described in detail here. Suffice it to say that the process is based upon the fact that from an alloy of gold and silver in which silver predominates in the ratio of about three to one it is possible to dissolve the silver by nitric acid, leaving the pure gold behind. To a weighed portion of the bullion is added an amount of silver which will bring the proportion up to three to one, if it is rich in gold, or, if it is rich in silver, sufficient gold to bring it up to this same proportion. This sample weighs one thousand gold-weight, or one half gramme; very nearly seven and seven tenths grains. It is rolled up within a piece of pure lead foil weighing about two grammes. An exact duplicate of this is made, as are also two similar samples from the opposite side of the bar. Two other samples are prepared of a weighed amount of absolutely pure, or "proof" gold, and silver, called the proof samples. A fourth set of samples is made from one thousand gold-weight of the bullion, which is likewise incased in lead.

These samples are then placed in cupels, in a furnace which has been heated to a bright red. A cupel is a small dish, a little more than an inch in diameter, made of boneash, and boneash is pulverized calcined animal bones. A cupel has the property of absorbing oxides of lead and other base metals when these oxides are formed during cupellation. What occurs in the furnace is practically this: The lead and other metals melt, and as the air passes over this molten mass the lead and base metals oxidize rather rapidly. A portion of these oxides are absorbed by the cupel and other portions pass off in the form of vapor. The final result of the process is a globule of gold and silver. The first three sets of samples (the top, bottom and proofs) which contain the proper proportion of gold and silver for parting, as the nitric acid treatment is known, are rolled out thin and placed in small cups of platinum. These cups fit neatly into a basket of the same material and the whole is then suspended in a platinum cup containing boiling nitric acid which dissolves the silver, leaving pure gold in the cup. This is very carefully dried at a low heat, placed in the furnace to be momentarily heated to a cherry red, removing the last possible trace of moisture and weighed on the scales upon which the samples were originally prepared. This weight shows the amount of gold in the bullion, after making the necessary corrections indicated by the proof samples' gain or loss during the process. The fourth set of samples, which after cupellation are globules composed of gold and silver, the base metal having been driven off during the cupellation, are weighed without any further preliminaries. Their loss in weight indicates the amount of base metal which was in the bullion. Having determined gold and base metal, the difference is reckoned as silver.

The scales used by the assayer in his work are the most delicate of the appliances used in the assay office, although the large balances upon which the deposits are weighed are themselves of extreme accuracy. But the assayer's scales take the palm. They are sensitive to one two hundredths milligramme. Fearing that it will not be realized what this means it will be explained further. These scales will weigh a lead pencil mark. Some time when you are in the assay office depositing the hypothetical gold from the hypothetical mine, ask the assayer to weigh a piece of paper an inch square. After he has done this make a mark across this paper with a soft lead pencil and you will be surprised to see that it is possible to weigh this mark. It will weigh anywhere from one to three one hundredths of a milligramme, depending upon the softness of the pencil and the breadth of the mark, of course.

The assayer having completed his work, reports the fineness of the bar and the clerical force gets busy on the calculation of its value. Knowing the weight of the bar and the proportions of gold and silver it is a mere matter of figures to arrive at its value. This done, you are given either a check or United States coin upon surrendering the receipt which was given you when you deposited your bullion.

The International Carat Adopted by American Jewelers

BY the adoption of the international metric carat for weighing precious stones and gems the American jewelry trade has taken an important step toward much needed uniformity and a single system of international weights and measures. This action was taken at a meeting held in New York on October 29th, at which were present representatives of the largest American firms. The resolutions adopted provided for the use of the international carat after July 1st, 1913, and requested the Secretary of the Treasury to employ this standard in levying the duty on imported diamonds and other gems. The international carat is 200 milligrammes or one fifth of a gramme (3.086 grains), and is now in use in France, Germany, and practically all countries except the United States, Great Britain, Belgium and Holland, where various carats corresponding approximately to 205 milligrammes are employed. It was established in response to a demand of dealers in precious stones in Germany in 1905, which was immediately supported by similar interests in France and other European countries. The carat, which originally was based on the weight of a seed, taking its name in fact from the Arabic word *carob*, meaning bean, never has been uniform or defined with scientific precision, and at the beginning of the twentieth century there were in use at least 20 different carats ranging from the Bologna carat of 188.5 milligrammes to the Arabian carat of 254.6 milligrammes. Hitherto American jewelers have used a carat corresponding to 205.3 milligrammes or approximately that of the British Board of Trade and of the jewelry trade of Antwerp, and dealing as they do with merchants in many foreign centers of trade the diversity has often proved most annoying. With the international carat not only will this lack of uniformity be done away with, but it will be possible to employ decimal sub-divisions instead of sixteenths, etc., and the actual weights for the balances can be made of the highest accuracy and referred to definite and legal standards. This action is quite in line with the general tendency in metrological reforms and attempts at uniformity, where it is found that the most satisfactory progress now can be made by taking a customary unit and defining it in terms of the metric system.

Inauguration of Emperor William Institutes

By Our Berlin Correspondent

TWO of the scientific institutes founded on the initiative of the German Emperor have been recently inaugurated in the presence of the sovereign and a brilliant circle of scientists. These new headquarters of physical science, installed within the boundary of the former royal domain at Dahlem, near Berlin, are destined to play an especially important part in the history of German Science, being the first large German institutes to have been founded at least partly with the means contributed by private persons and where the men of science will first have an opportunity of giving themselves up exclusively to free research work, untrameled by the duties of university teaching.

These two grandiose establishments are the Emperor William Institute of Chemistry and the Emperor William Institute of Physical Chemistry and Electrochemistry; they are housed in an extensive group of beautiful cottages situated close to the terminal station of the Wilmersdorf-Dahlem Electric Subway now under construction. The Institute of Chemistry will be under the management of Dr. Beckmann, late professor of Leipsic University, who will be permanently assisted by Dr. Willstätter, late of Zürich University, well known for his researches on chlorophyl, and temporarily by Dr. Hahn, the eminent specialist in the field of radium and thorium research. The Institute of Physical Chemistry and Electrochemistry will be under the direction of Dr. Harbor, called away from the Carlsruhe Technical High School and who has made a name for himself by his recent synthesis of [illegible]mosiac.

In his address, the Emperor announced his intention of inviting the co-operation of chemical science in searching for prophylactic measures destined to protect the men working underground against mine catastrophes.

Dr. Harnack, president of the Emperor William Society, in his speech, announced the forthcoming foundation in Rhenania, with funds contributed by the city of Mülheim, of an institute for coal researches. It would be desirable, Dr. Harnack said, if every great city of the country in its turn founded an institute of scientific research. A clinical radium institute destined to investigate the influence of radium emanation on the human organism in a healthy morbid condition would, by the way, be founded in the near future, and the Emperor William Society also intended to promote aeronautics and aviation in their theoretical foundations. The society further saw one of its main tasks in the promotion of biological investigation, for which purpose the zoological station of Rovigno had been purchased. Other institutes to be founded included an institute of experimental therapeutics and an institute of the physics and hygiene of work, where the beneficial or detrimental influence of work on the human organism and the preserving and increasing of its working capacities would be investigated. The society also co-operates in the excavations of Samara and has helped in organizing an expedition for the fighting of sleeping sickness in New Cameroon.

The funds of the Emperor William Society amount to the total of $3,200,000.

Luc Bink—A Plant that Produces Textile Fibers

THE use of the plant known as Luc Bink for producing textile fibers is the subject of a communication made by the French scientist, Perrot, to the Chamber of Commerce of Saigon, and his report on the subject is of interest from a commercial standpoint as being of a nature to develop the industry in Indo-China. The plant is of an aquatic variety to which the Annamites give the above name, and its botanical name is *Eochornis crassipes*. What is remarkable about this plant is that it spreads very rapidly, so that within a short time it covers small ponds and even large lakes. It is said that a single stalk grows in a few months so as to cover a surface of 700 square yards. It appeared in Cambodga in 1902 and seems to have come from Java or the Philippines, or perhaps from Japan, and since that time its growth has been so remarkable that the authorities are becoming alarmed about it on account of the hindrance to navigation. They advise the natives to pull it up and burn it on the shore, and the Battanbang province has already devoted a good sum for this purpose. M. Perrot observed that the plant had strong fibers which could, no doubt, be used for textile purposes. After stripping the leaves, he put the stalks in a Duchemin machine so as to obtain the fibers, and after drying in the shade he found these to be in good condition and of supple nature. He was able to make rope and string or coarse thread with which matting or canvas could be woven. A solid and elastic furniture backing can be made of it so as to replace cane seating for chairs. A most practical use of the threads will be to use them instead of jute for making rice sacks, and these are now used in great quantities in Indo-China. Using a Cambodgan loom he produced a strong and flexible fabric, which was at least as stout as jute bagging. With the same height and width, the sacks have the same weight as jute sacks, but he found that the weight could be reduced by treating the fibers with a chrome alum bath, and this acts to tighten the fiber and close up the pores so as to render it anhydrous. The fibers will take any kind of dye, and as to the breaking strain, he found that a 0.2 inch cord of 3-foot length would support a weight of 100 pounds with an elongation of 4 inches. According to his process, 200 pounds of the green stalks, after removing the pulp and drying, will give about 9 pounds of good fiber ready for use, and this process can be carried out by the natives. The fiber could be baled in the usual presses so as to export it in small bulk to the European cord factories.

The Tehuantepec Railway

THE Tehuantepec Railway, opened in January, 1907, has, according to article in *Weltverkehr*, vastly outstripped its rival, the Panama Railway, and will probably not be seriously affected by the opening of the Panama Canal. In the year ended June 30th, 1911, the traffic over the Tehuantepec route was nearly threefold that over the Panama route. The excellent terminal ports, Puerto Mexico and Salina Cruz, are visited by 20 steamship lines, besides the fleet of steamers maintained by the railway.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Recent Wreck on the N. Y., N. H. & H. R. R. at Westport, Conn.

To the Editor of the SCIENTIFIC AMERICAN:

The article published in your issue of October 26th, 1912, upon the recent wreck at Westport is so unfair in its presentation of the case, and so faulty as to facts, as to demand an answer, and I assume that you would prefer that it be made in your own columns, and that you will not refuse space for this purpose.

The technical character of your journal confers upon its articles greater weight than accorded those in the non-technical press, and the reputation of the New Haven Company with the traveling public should not have been assailed without first having exhausted all reasonable sources of information as to the accuracy of the published statements of facts.

The plain facts brought out in the course of the hearing held by the Interstate Commerce Commission made evident the unusual simplicity of the case, which was unclouded by controversies as to facts or by adverse testimony.

A fast express train running at a speed between fifty and sixty miles per hour traversed a No. 10 crossover between adjacent tracks and was wrecked. For reasons which the unfortunate death of the engineer makes it forever impossible to explain, the time card rule, requiring a reduction of speed to fifteen miles per hour on all "crossovers," was neglected. Without reducing speed, the engineer successively passed the distant signal 3,700 feet from the crossover, which was set at caution; a drawbridge, over which a maximum speed of 30 miles per hour was fixed by the rules; a worktrain conductor and signal towerman, who were both vainly trying to attract his attention; a section foreman standing directly ahead on the same track, frantically endeavoring to "wave him down;" a home signal set at danger, and finally a "dwarf signal" permitting the use of the crossover only at speeds not exceeding 15 miles per hour, with the inevitable and disastrous consequences.

In short, the engineer "ran by his signals," an occurrence which is lamentably frequent, and always most dangerous.

The most searching inquiry failed to disclose any weakness of track, failure of signals or faulty train equipment. The experienced inspectors of the Interstate Commerce Commission and of the Public Utilities Commission of Connecticut have inspected the track, signals and equipment, without suggesting a fault at the subsequent public hearing held in New York.

In the previous article the New Haven Company is directly charged with the maintenance of unsafe crossovers in its track, and general neglect in the conduct of its operation. The article was written without previously ascertaining the conditions and character of the crossovers on the New Haven road, and had the writer followed the accepted practice of reputable journals in previously submitting a proof to the railroad company for criticism and comment, he would have been given a schedule showing the large number and unusually high proportion of long crossovers (No. 15) already installed in the main line tracks between Boston and New York, and would have been informed of the existing standing orders to replace all the shorter crossovers whenever practicable, and as rapidly as possible, following the previous accident at Burr Road.

This sapient critic, who doubtless derives his knowledge from some relative "in the railroad business," secures the use of your columns, and proceeds to draw bizarre and alarming pictures of some unrecognizable parts of an engine, indulging in all the unruly gyrations of an untamed Western bronco, and after showing just how the engine must have left the rails on the curve, indicates in his subjoined sketch that the derailment occurred, in fact, on the main line track, some 90 feet beyond the end of the crossover.

Attention is called to the pronounced "jog" in the crossover curve, which it is explained indicates careless maintenance, but without explaining that the picture was taken *after the wreck*, and without commenting upon the surprisingly good condition of the track, which, while designed for train speeds of fifteen miles per hour, almost passed in safety a train at sixty miles per hour. How many cases has the writer seen in which a crossover was left in such good condition as in this instance?

He cites the short crossovers of the New Haven road in disparaging contrast to the long crossovers of the Pennsylvania and New York Central companies, but says nothing of the percentage of long to short crossovers in the tracks of any of these railroads, leaving it to be inferred that the New Haven Railroad is the sole and exclusive depository of a special brand of short crossovers, not enjoyed in common by the other railroads of the United States. From his inner consciousness he evolves a new variety of crossover unknown to the railroad world, which, in his own words "can be made absolutely safe for the fastest speed at which an engineer can pull his train through them."

He asks if our witness does not "know that on that road (P. R. R.) there are crossovers which are so easy in curvature and of such great length that the railroad has imposed no speed limit whatever upon the engineers in running over them," which would be humiliating had we not been previously informed by Mr. L. R. Zollinger, Engineer of Maintenance of Way for the Pennsylvania Railroad Company, that the longest crossover on the Pennsylvania Railroad was No. 20, and that with one exception the maximum speed permitted by the rules of his company on all crossovers longer than No. 14 is 35 miles per hour, and 15 miles per hour on all other crossovers; and had we not been informed by Mr. A. T. Hardin, Assistant Vice-President of New York Central & Hudson River Railroad Company, that a maximum speed of 30 miles per hour was allowed by his company on the maximum crossover (No. 18), and then only under special notices in time-tables, the speed on all other crossovers being limited to 10 miles per hour. Curiously enough, both of these gentlemen seem to be without access to the wealth of knowledge regarding their own lines so brilliantly displayed by our critic.

It is news to all signal engineers that an automatic train stop device has been perfected which will stop a train on a "clear route" set for a crossover, and it may possibly be news to our editorial critic that the Board of Train Control appointed by the Interstate Commerce Commission, with the aid of a Government appropriation, and after several years of experimentation, failed to find a single automatic train control system which met their requirements, or which was specifically recommended for adoption by the board.

It is contended that the existence of a longer crossover at the scene of the wreck would have averted the consequences of the engineer's disregard of orders and signals, which is possible, but not probable; but unfortunately for the peace of mind of the railway managers, no clew is afforded as to the particular kind of buffer or bag scoop devised to catch trains which may pass the adverse signals at railway grade crossings, or open drawbridges, and which may leave the "derails" at speeds of 60 miles per hour or more. The wrecking of a train disregarding signals at a crossover should not be regarded as a crime in contrast to the intentional wrecking of a train at crossings and drawbridges, which is accepted good practice, and no essential distinction between the two cases is apparent.

Then follows the conclusion expressing the familiar and stereotyped hope for "early and drastic legislation." There is every reason to believe that this hope will be realized, and past experience permits an accurate forecast of its form, which will be substantially as follows:

Federal, State and Municipal Commissions will be multiplied, with extended powers, on which, under no circumstances, will the railways be granted representation, which will contain no member suspected of railway affiliations, nor any one possessing practical and specific knowledge of the subjects to be considered.

The guilt of the railways will be assumed in advance, and the burden of proof to the contrary will rest upon the said railways. The right of appeal will be denied, and the courts of appeal abolished. (N. B. To hell with the Constitution.)

The payment of dividends to its stockholders by any railway company within the period of ten (10) years next preceding the date of any suit or action for damages brought against it shall be considered *prima facie* evidence of guilt on the part of the said railway company, and judgment entered accordingly.

A degree of foresight in the prevention of accidents will be required of the railways, which will at least equal the "hindsight" of the investigating board after each accident.

It shall be the duty of the new and enlarged boards to require the installation of all possible forms of new, untried, complicated or costly mechanical and electrical devices of a character adapted to provide against the most remote contingencies. Two or three million safe operations will not be allowed to excuse one failure, and if necessary to insure this degree of protection, the roadbeds must be festooned with mechanical garlands, to even the exclusion of the sun's rays.

All track-ties must be replaced annually. Engineers will not be expected to regard signals, but nothing in the act shall be construed to relieve any railway company from full responsibility for the acts, failures or omissions of its employees; strikes, riots, floods and acts of God to the contrary notwithstanding.

No crossover shall be shorter than the longest crossover in service on any adjacent railway, regardless of limiting local conditions, and all crossovers, sidings and industrial spurs diverging from switches in main tracks shall be constructed in such manner as to permit the safe passage of trains "for the fastest speed at which an engineer can pull his train through them."

A penalty not less than \$10,000 and not more than \$50,000 will be imposed for each and every "jog" in track, occurring as the result of a previous train wreck.

The immediate and simultaneous replacement of all passenger equipment by steel cars to an amount not exceeding \$1,000,000,000 will be prescribed.

The special boards to be created or extended under the terms of the act will be prohibited from extending aid or assistance to the railways, tending toward the restoration of their lost control of operation, affecting the safety of the traveling public, nor will they be permitted to read the chapters on 'Preventable Accidents by Mr James O. Fagan, in his "Confessions of a Railroad Signalman."

The "human equation" shall not be investigated to the political detriment of the party in power.

Adverse judgments must invariably be rendered against the richest and most responsible corporation included within the field of inquiry, always excluding organizations and individuals having votes or slender resources.

In compensation for any additional burdens that may be imposed under the terms of the act, the railways will be permitted to reduce their rates in the proportion of 10 per cent decrease in rates for each 20 per cent increase in the amount of the burdens so imposed.

Boards of investigation should conduct the examination of witnesses primarily for the benefit of the "yellow press," keeping in mind the secondary importance of developing the fundamental causes of train wrecks and means of prevention.

In the investigation of train wrecks by the boards, no apparent lack of evidence unfavorable to the railway company should be accepted as conclusive. The public demands that an example should be made in such cases, and it is the plain intent of the law that such boards shall earn the salaries paid them by providing a victim under all circumstances.

Railways will be required to employ complete duplicate staffs of operating officials in order to insure the safe conduct of operation during the absences of the regular staff in attendance at the hearings before the duly appointed boards, and all such officials will be expected to memorize all forms of statistical data, rates, car numbers, way bills, equipment lists, dates and details of contracts or other records for the convenient use and information of the examining board.

The press will be enjoined from publishing any evidence which may seem to favor the railways, and no technical journal shall be required to check the accuracy of its statements in advance of publication.

This forthcoming "drastic legislation" will certainly be popular with the general public, and following previous precedents there can be no reasonable doubt of its passage. There only remains to be added the enacting clause and date to make the bill complete.

E. H. McHENRY, *Vice-President,*
N. Y., N. H. & H. R. R. Co.

[*Comment on the above letter will be found on our editorial page.*—EDITOR.]

Our Backwardness in Aviation

To the Editor of the SCIENTIFIC AMERICAN:

In answer to your editorial, "A Promise Unfulfilled," in the edition of September 21st, I suggest that the trouble is in the temperament of the people. They continually read of the aeroplane as being a great factor in war, and as it is scarcely ever heard of in any other connection, they get the impression that it is of no use otherwise. As the American people are fast losing all warlike proclivities as being unnatural and inhuman, they turn from things so distasteful to their views of reason and justice. A. A. HANSMAN.

Colorado City, Colo.

The Temperature of Bread Dough

To the Editor of the SCIENTIFIC AMERICAN:

Why not "do it in your head"? Multiply Centigrade by 2, deduct (10 per cent) 1/10, and arbitrarily add 32.

The boiling point of Centigrade, 100 degrees, multiplied by 2, gives 200, deduct 1/10, 180, add 32, and you get boiling point 212 deg. Fahr.

Centigrade $10 \times 2 = 20 - 1/10 = 18 + 32 = 50$ deg. Fahr., a very simple sum in mental arithmetic. Everybody may know the above, but if there are a few who do not, the above plan may help.

And while we are on temperatures, if a domestic scientist wants to "set" her bread at a given temperature, say 80 deg. Fahr., she multiplies the sought-for temperature by 3, which gives 240 degrees. Then adding the temperature of the kitchen, say 75 degrees, to the flour, say 65 degrees, we get 140 degrees, and deducting same from the first gross temperature, 240 degrees, we get 100 degrees, which is the proper temperature for the *added liquids* to make a dough at 80 deg. Fahr.

Point Loma, Cal. CHARLES CRISTADORO.

The Mining of Herculaneum

A Splendid Opportunity for the Archeologist

By Professor Alfred Emerson, Art Institute of Chicago

AN American explorer of large experience and fine spirit, Dr Charles Waldstein, has advocated a complete, final disinterment of Herculaneum, the buried Roman city at the foot of Mount Vesuvius, by international subscription. The Italian government has lent a favorable ear to part of the Cambridge professor's proposal. It has decided to employ capable mining engineers on that enterprise, who will conduct it with pneumatic rock-cutters by electric light, instead of elbow-grease and torchlight. But it has rejected the co-operative feature. Short of cataclysms like the Messina earthquake, Italy prefers not to pass the hat. And Italy holds all the dice in the proposed archeological game. So far so good. Unfortunately, the problem has only been navigated back to the starting point. No sooner had the national government given a new twist to the comatose underground exploration in 1908 and 1909, than litigation arose over the compensation of real estate holders in the modern cities of Portici and Resina, which crown the lava beds above ancient Herculaneum. Courts are slow and timid. Resina will not relent.

Prince d'Elbeuf discovered the remains of the buried Campanian town by accident in 1719, under his country seat at Portici. The impending bicentenary of that event promises to be a sorry celebration, with nothing done to revive the torpid enterprise. Archeology will not languish on account of Mr Waldstein's disappointment. But Italy might cease to be its chief nursery hereafter. The world will give its better attention, as scholars are already doing, to French Africa and Egypt, to the isles of Greece, and above all to that eastern half of the vast Roman empire which Strzygowski has christened the virgin soil of art history—to Asia Minor. Herculaneum will please stay dead!

The mysterious underground city somehow refuses to do this. Its strange rediscovery is too closely interwoven with the rebirth of intelligence, and of modern history itself. Let us see if this is not so.

The resurrection of Herculaneum and Pompeii in the eighteenth century took the imagination of all Europe captive. The dead occupants of the two Vesuvian ports conquered the modern heart. To be exact, all the new and near glimpses of classical antiquity that were thrown open toward 1750 and after worked together. Stuart surveyed the antiquities of Athens. Rome gave up a harvest of statues. A great Italian engraver portrayed the majestic ruins of the imperial city in a thousand noble etchings. "The glory that was Greece and the splendor that was Rome" penetrated philosophy, letters, the arts of design and even costume. Watteau's courtly gallants and powdered belles ceased to please. This convulsion of Europe's taste foreshadowed the later social and political revolution. First Alfieri's "Brutus" and Chénier's "Messenian Odes"; then Goddess Reason, the Consulate and the Corsican Cæsar.

A clever Frenchman has described the beginnings of modern neo-Greek and neo-Roman art under the caption "Empire Art Under Louis XV." He proclaims Piranesi its founder. Other big stars in the new art firmament bear familiar names: Wedgwood and Flaxman, David and Percier, Canova and Thorvaldsen. The classical wave reached America. From Maine to Missouri, Grecian porticos still add dignity to the manse and majesty to the county magnate's mansion.

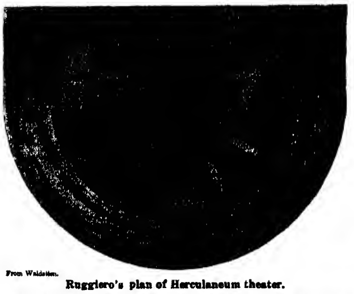
A long and singular oblivion overtook Herculaneum and Pompeii after their volcanic burial in the reign of Titus, A.D. 79. The refugees from the nearer suburb obtained the freedom of Neapolis, the Græco-Roman Naples. Posterity forgot the buried towns, although the Greek and Latin writers who relate their history were easy of access and both places lay close to a busy highway. One stroke of the pick was enough to betray the secret of Pompeii's underground survival. Its old hilltop temple of Hercules and its tall amphitheater were, in fact, never buried at all by the cloud of light pumice stone which fell on that section of the shore. Farther west, a deluge of volcanic mud filled every cranny of the sister city. This blanket of wet volcanic cinders hardened to a stratum of solid rock, and is crossed only on top by lava streams of much later origin. The resultant condition is a sixty-five-foot stratum of very hard natural concrete and lava between the antique and the modern street levels, as against eighteen feet of loose, light gravel at Pompeii, with upper stories of submerged constructions outcropping.

In spite of all this, Herculaneum was tapped first. A princely foreign resident of Portici sank a well on his grounds, as we have seen. As luck would have it, his men penetrated through recent lavas to the heart of a lofty antique structure which was embellished with many statues of white marble. Prince d'Elbeuf extracted twenty columns of colored stone and ten or a dozen gracefully draped female figures from the theater and contiguous ruins. Some of these were afterward identified as the daughters of Nonius Balbus, the builder of the municipal court-house. Elbeuf astutely presented three of his statues to Austria's popular mili-

From Waldstein-Shoobridge.

Beloch's plan. Reduction 0.28.

Note obliteration of antique shoreline by modern lava flow, the royal palace and park, the underground sites, *casa dei papiri, theatrum, templum, basilica*, baths (*thermæ*) and the recent excavations (*scavi nuovi*)



From Waldstein.

Ruggiero's plan of Herculaneum theater.

Note scene and proscenium walls, and Prince d'Elbeuf's open well mouth.

Photo. Giorgio Sommer.

Model of Herculaneum theater on view at Resina.

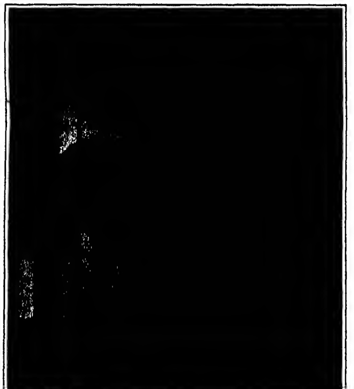


Photo. Giorgio Sommer.

Reassembled bronze horse from peak of theater.

THE MINING OF HERCULANEUM

...ro, Prince Eugene. Austria ruled Naples at this ... Its local authorities, however, confiscated the ...nder of Elbeuf's marble harvest, and stopped his ...wing, without pursuing the work on government ...nt. The Elector of Saxony bought the Vienna ...s of Eugene's estate, and they are at Dresden yet.

...enty years later, Naples is a Spanish secundo...ture, and King Charles, who afterward became C...rles III. of Spain, is laying out a summer palace o... the site of Prince d'Elbeuf's old chateau. His archi...t... opened another well, or shaft, hoping to quarry horses they found in position on that architectural eminence. Their royal master proved equally brilliant. Part of the crumpled bronze quadriga was idiotically converted into bas relief portraits of the king and queen, and church furniture, although the heads of these brazen steeds surpassed those of San Marco at Venice! The bronze fragments were allowed to lie in a corner of the palace yard, a prey to passers-by, for many years, even after an able artist, who was summoned from Rome, had managed to rebuild one composite animal with the remains of all. All Naples the new shafts. Unpropped rock ceilings and walls fell in and endangered the modern town overhead. Alcubier's activity and petty jealousy were a burden to his abler Swiss and Italian subordinates until his death in 1780. But no trained expert was ever more fortunate in his digging, and the king stood by him while the crusty old captain filled his palace with the spoils of Herculaneum. A Roman basilica or courthouse 250 feet long, close to the theater, yielded some fine imperial portraits of the Augustan era, and two marble equestrian portraits of Herculanean noblemen.

From Waldstein.

Metrodorus on the senses and Philodemus on signs, found in the villa of the Papyrus Rolls.

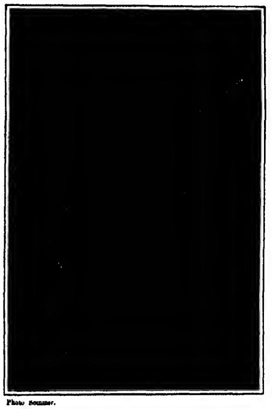
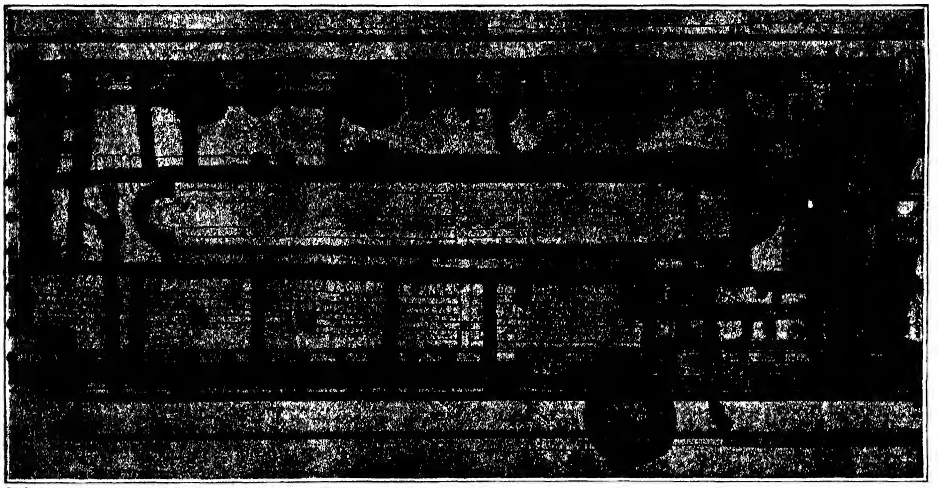


Photo Sommer.

Marble Pallas Athena found in tablinum of villa, near 46 on plan. Greek style of about 490 B. C.

Photo, Sommer.

Wrestler or disk-thrower. One of a pair found at 74 and A on plan.



From Waldstein.

Outer peristyle or garden of the villa of the Papyrus Rolls. Capt. Alcubier's plan of his tunnels.

Note passage to inner peristyle at 46, Alcubier's main shaft at 2, 3, 4, 11, his refilled scoops at 48 to 70. Also, bronze statues in sites at A, B, C, etc., and the 220-foot fishpond. Nearly all the statuary of the villa was recovered in this garden.

THE MINING OF HERCULANEUM

broken antique marble from it for the royal limekiln. Alcubier, the king's master of the works, was more of a soldier than a scrivener. His Spanish diary of the dig is quaint reading. Naples, as Shakespeare would have called Charles, was very lucky. The diggers happened this time on the topmost pinnacle of the old theater, with a big Latin inscription on it that identified the building as a public monument of the long-lost Roman town. But the king's incapable servants never quite made out whether it was four or six gilt bronze laughed at the curious medical attentions this brazen horse required. After every hard shower, the castle gates were closed for the king's steward to empty its belly with a pump.

The same incompetence governed the tunneling operations. The royal excavator bored only for artistic treasures of a portable nature, like statuary and fresco paintings or mosaics. Little attention was given to the architectural relics or to the planning of buildings. Old shafts were choked up again with the rubbish of A rectangular temple yielded several Greek monochromes on marble and four big mythologies in fresco.

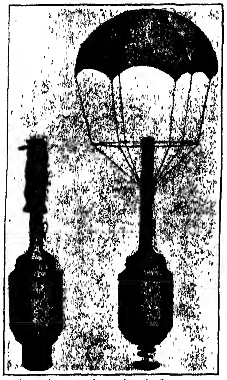
In the fifties Alcubier worm-holed a vast private mansion, a regular Roman palazzo, with horizontal shafts. Comparetti and De Petra have almost proved, in a recent monograph on this building and its contents, that its first owner was one of the illustrious Pisones, and once the Roman governor of Thrace. Horace dedicated his "Art of Poetry" to this man's descendants,

(Continued on page 428.)

A Parachute Bomb for Aeronautic Use

SINCE airships and aeroplanes have been added to the military equipment of nations, the want of bombs really suitable for launching from these aerial vessels has been keenly felt. The bombs that have hitherto been used for this purpose have one or more of the following defects:

1 When a bomb which is exploded by impact is



Aasen's parachute bomb for aeronautic use.

thrown from a great height it acquires, in falling, a velocity sufficient to bury it so deeply in the earth, before the explosion occurs, that its lateral action is annulled, because all of its projectiles are discharged underground instead of scattering and carrying destruction in every direction over the earth's surface

2 A bomb dropped from a moving airship has initially the horizontal velocity of the vessel, which may exceed 60 feet per second Hence the bomb will not fall vertically on the object aimed at, but will descend obliquely and strike the ground at a distance from its goal that cannot be calculated with accuracy. The effect of the explosion, furthermore, may be diminished by two thirds, or more, by the obliquity of the axis at the moment of explosion.

3 The projectiles share the vertical velocity acquired by the bomb in falling from a great height and are therefore discharged, not horizontally, but obliquely downward into the earth Hence the useful effect would be annulled even if defects 1 and 2 did not exist

4 When the bomb is cleared for throwing, its safety catch or cap is released or removed. Under these conditions a misdirected throw or other accident may precipitate an explosion which would seriously injure or even wreck the airship

In Aasen's bomb these defects are remedied in the following manner

1 The bomb has a very sensitive contact exploder which produces an explosion the instant its tip touches the softest ground, or even a water surface Hence the bomb cannot penetrate the earth before exploding.

2 The bomb is provided with a small parachute which quickly destroys the horizontal velocity communicated by the airship The bomb, therefore, falls vertically on the spot over which the airship is passing, and its axis remains vertical, so that the projectiles are discharged horizontally in all directions and produce the maximum effect, throughout an area of more than 8,000 square feet

3. The parachute can be arranged to limit the vertical velocity of the bomb to 100 or 200 feet per second, as may be desired These velocities produce no appreciable effect on the paths of the projectiles, as the exploding mechanism is contrived to counteract their influence

4. The exploding mechanism is so constructed that it cannot act until the bomb has fallen 66 feet Hence the bomb cannot explode in or near the airship

The bomb, when loaded and ready for use, weighs about 11 pounds and contains 400 projectiles, which have an effective radius of action of at least 80 to 100 feet from the point of discharge The weight of the explosive charge is about one pound

These bombs are designed for use against detachments of infantry, cavalry and artillery. Very much larger explosive charges must obviously be employed for effective attack upon warships and fortifications. —Translated for the SCIENTIFIC AMERICAN from *Kriegstechnische Zeitschrift.*

Using a Frog's Leg as Wireless Telegraph Receiver

By Our Berlin Correspondent

GALVANI'S well known experiment, which in spite, or rather because, of its being wrongly interpreted, gave rise to the development of galvanic electricity, has become a familiar classroom demonstration, especially in lectures on physiology. A peculiar use has been recently made of the phenomenon by adapting it to the recording of electro-magnetic waves such as used in wireless telegraphy.

Dr. Lefeuvre, professor at the Medical High School of Rennes, has, in fact, devised the following arrangement for recording the contraction of a frog's muscle as produced by the passage of an electric stimulus through a motive nerve:

The muscle *M* is solidly fixed in its upper part by means of a pair of tongs, as shown in Fig. 1. The end of the sinew is connected by means of a wire to a light lever *L* pivoted at *O*. This lever is returned to its initial position, after the contraction is completed, by a weight suspended from it, and the end of the lever, which carries a fine point, bears against a rotating smoked cylinder. At the very moment the muscle is excited through the intermediary of its nerve *N*, the contraction curve, enlarged by the lever, is recorded faithfully on the smoked cylinder. While many cold-blooded animals can be used for this experiment, the muscles of frogs' legs are particularly well adapted for the purpose, on account of the regularity of their form, the long duration of their excitability and the special ease with which they can be severed from the body

So far from severing the muscle completely from the body of the animal, it is, however, preferable to leave it in position, cutting the "Achilles" sinew at its junction, and fixing it to the wire connecting with the lever. In this case, the central nervous system of the animal should, however, be destroyed, lest the experiment be disturbed by motive reflexes. The sciatic nerve is dissected over a short distance at the level of the thigh, and is lifted by means of the hooks of wire supplying the electrical stimulus.

This neuro-muscular apparatus is so extremely sensi-

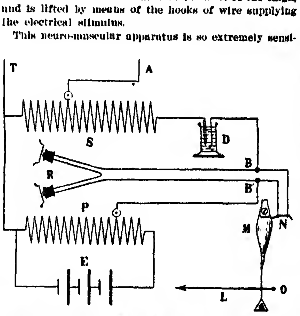


Fig. 1.—Diagram of the receiving station.

Fig. 2.—Recording a wireless telegraph message with the aid of a frog's leg.

[illegible] galvanometer, [illegible] variations or waves to be detected. [illegible] ment above referred to [illegible] the advantage of allowing its readings to be recorded, [illegible] actually be employed in the following arrangement for the receiving and recording of wireless signals.

The receiving station (Fig. 1) comprises the following; *E* is a battery of three cells, *P* a potentiometer allowing the voltage in the receiving circuit to be controlled, *S* is a tuning coil to which the receiving antenna *A* is connected, *D* an electrolytic detector, and *R* two

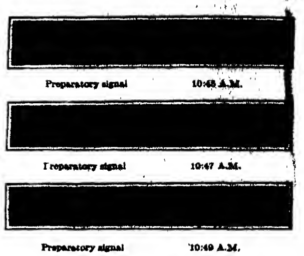


Fig. 3.—Eiffel time-signals recorded by the frog's leg.

high-resistance telephone receivers connected up in series.

To the terminals *B*, *B'* of these telephones are connected, in shunt, two wires applying the electrical stimulus to the nerve *N* through the intermediary of small metal hooks. The excitation of the nerve is due to the self-induction currents produced in the coils of these telephones.

The tracings reproduced in Fig. 3 have been obtained at Rennes by means of the arrangement above described and are records of the time signals given out daily from the radio-telegraphic station of the Eiffel Tower. The distance between Paris and Rennes is about 185 miles. These signals comprise a preliminary signal calling the attention of the observer to a subsequent signal of very short duration which marks standard time. The time markings are sent out from the clock of the Paris Observatory, which is fitted with a contact, actuating the transmission set of the Eiffel Tower. They are sent every morning at 10:45, 10:47 and 10:49, respectively. The preliminary signals are different for each of these markings and can be expressed in the Morse alphabet. The tracings allow the preliminary as well as the time signals to be distinctly recognized, and when choosing a very fine style and only slightly smoked paper, they are seen in their upper part to show very fine indentations, the number of which corresponds to the rate of vibration of the transmitting apparatus.

This method of recording time signals is of remarkable accuracy. The time passing between the moment of excitation of a frog's muscle and the moment of its contraction is, in fact, extremely short. Moreover, this time—the latent period of contraction, as it is called—is a well known factor—in the present case about 0.01 second—for which due allowance can be made. As regards the delay due to the time taken by the wave in traversing the distance between Paris and Rennes, this is absolutely negligible, the rate of transmission of Hertzian waves being practically the same as the velocity of light, viz., 186,330 miles per second.

While this arrangement is an interesting laboratory apparatus, it is hardly likely to become commercially practicable.

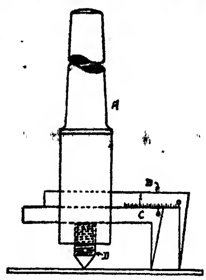
Horse-power and Kilowatt

THE British Association for the Advancement of Science adopted, as early as 1873, 746 watts as the equivalent of the British and American horse-power, and 736 watts as the equivalent of the metric or Continental horse-power, says *Machinery*. In a circular recently issued by the United States Bureau of Standards, it is stated that in all future publications of this bureau the former value, 746 watts, or 0.746 kilowatt, will be used as the exact equivalent of the English and American horse-power. For scientific work, it is quite important to have the horse-power thus standardized by being expressed in the so-called "absolute" system of measurement, because the common definition of 550 foot-pounds per second is scientifically correct only at a certain latitude and altitude, on account of the fact that the pound-weight, as a unit of force, varies in value as *g*, the acceleration of gravity, varies. The horse-power when expressed at 746 watts is equal to 550 foot-pounds per second at 50 degrees latitude and at sea level.

A Tool for Cutting Gaskets

By H. D. Chapman

THE accompanying sketch shows a gasket cutter of inexpensive construction, which may be adjusted to cut gaskets of any desired size. The shank *A* of the tool is made of machine steel and tapered to suit the drill press spindle. The body of the tool is slotted to receive a pair of cutters, *B* and *C*. These cutters are made of tool steel, and one of them is graduated in sixteenths of an inch, as shown in the illustration.



Gasket-cutting tool.

This permits one to tell what size of gasket he is cutting. In the lower end of the body of the tool a setscrew *D* is threaded. This is adapted to bear against the two cutters, holding them in position. The setscrew has a one eighth hole drilled through it, so that it may be tightened up with a pin. The outer end of the screw is turned to a 60-degree cone point. In use, this point is sunk into the material, and the tool is revolved about the center, cutting out the gaskets. This tool will be found suitable for cutting gaskets from any material with the exception of metals.

Welding Extensions on Small Drills

By Nathan C. Johnson

A NECESSITY of very frequent occurrence in practically every workshop is the lengthening of the shank of a small twist drill. This is particularly true of the amateur shop; and when the necessity arises of drilling a hole deeper than the length of the shank on the standard twist drill, the problem of welding on an extension is one of serious aspect. Indeed, it may be said that a weld of this kind, particularly if the drill be under 3/16ths of an inch, is a very difficult matter, even for a skilled blacksmith, as it is almost impossible to heat the shank of the drill to a welding heat without spoiling the steel, or drawing the temper in the rest of the drill at the very least.

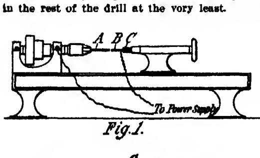


Fig. 1.

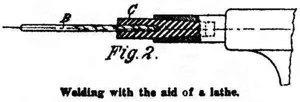


Fig. 2.

Welding with the aid of a lathe.

With the object of overcoming these difficulties, the following simple method of making the weld was devised. It will be seen at a glance from the drawings that the means used was the electric current, but it was impracticable to use a current heavy enough to heat the drill, owing to its resistance, so the heat of the electric arc was employed.

To hold the drill and the extension rod in line and also to regulate the arc, a small bench lathe was pressed into service. From Fig. 1, it will be seen that the extension rod *A* is held in the chuck on the headstock. To this latter is also attached one terminal of the electric circuit. In the tail stock is fitted a plug of hard rubber, or fiber *C*, tapered at one end to fit the tailstock and having a socket at the other of such a size as to hold the drill *B* to be lengthened. This rubber, or fiber, piece holding the drill is to insulate it from the rest of the machine; and the other terminal of the electric circuit is attached to the drill directly.

It will now be seen that if we turn the handwheel on the tail stock so as to bring the extension rod and the drill into contact, we will complete the electric circuit. If then we unscrew the tailstock a little, we shall draw out an arc between the two pieces. It takes but a few seconds to have the two pieces at a melting heat; and if the arc is looked at through blue glasses, it will be easy to determine when this condition has been attained. When the metal is seen to be molten at the extreme tips of the drill and the rod respectively, screw in the tailstock quickly. This forces the two butts together; and after cooling off, it will be found that a most excellent weld between the two has been produced, the electric weld having the added advantage over common welds that it is most sound at the center, with imperfections on the outside, while the reverse is true with blacksmith welds. All that is necessary now is to remove the terminals from the pieces and dress the weld off with a fine file.

Drills down to the very finest can be easily and accurately welded to extensions of any length by this means. There is no roughness to the weld; it is strong; and because of the use of the lathe, not only is the arc under perfect control, but the resulting drill is in perfect alignment—a most desirable quality.

As a source of current, an attachment to an electric light socket has been used for the finer sizes. For larger sizes, it may be necessary to re-fuse the rosette from which the drop is taken; but even for large drills, up to ¼ inch, 2 amperes at 110 volts is amply sufficient.

Workshop Notes

Method of Removing Broken Screws.—In order to get out broken screws, bolts, and short studs, which were not long enough to be gripped with pinchers, gas pliers, or jam-nuts, the writer has successfully used a nut (employing various sizes for various screws) cut through from one side with a hacksaw to form a split nut. The split nut was screwed on the screw as far as possible, then it was gripped in a pair of pinchers or gas pliers in cases of light work or in a clamp or hand vise for heavier work. The nut in turn gripped the screw so that it was easily unscrewed. Such a nut may also be used to hold short round- or flat-headed screws or setscrews while they are cut to desirable lengths with hacksaw or file, which operation is very bothersome, especially if the screw is so short that the part that is to be taken off does not let the wire get a good grip on it.—G. H. Ander

Non-rusting Treatment for Tools.—All iron tools, such as squares, wrenches, pliers, dividers, screw drivers, etc., have the unwelcome property of rusting. In damp shops the tendency is even more marked. For all such cases as arise with plain iron tools (those not plated or painted) the following treatment will be found to be an efficient preventive measure. Obtain some potassium bichromate (five or ten cents worth will be sufficient for a gallon of solution) and some sodium hydroxide (lye). The water used as a solvent should be distilled and warm or hot if possible. To a gallon of water add about one or two tablespoons of the hydroxide (lye) and after it is dissolved add the bichromate. Make the solution saturated, i. e., put in as much of the bichromate as will dissolve. Since the crystals do not dissolve very fast, the solution should be stirred. Now clean the tools, utensils, or the like which are to be treated. They should be smoothed and polished if possible. Sandpaper or emery paper or cloth will be found serviceable for this purpose. Then submerge the tools in the solution. When several pieces are treated at the same time they should not touch or interfere with one another. The treatment should last as long as possible. This may be for one, two, or more days, or even for several weeks. The tools may be taken out of the solution and used as needed and then reinserted in the solution. In such cases care should be taken to keep the tools clean or else to reclean them. Some tools, as screw drivers, squares, dividers, etc., can be left in the solution continually, day in and day out, and be taken from the solution as needed. This method will keep them bright indefinitely. If the solution evaporates, it can be replaced with more water or bichromate and lye as needed. Ordinary tools can be washed and wiped with a cloth after treatment without destroying the non-rusting effect. This treatment should be very valuable about the shop, and since it does not injure the tool in any way, it is applicable to fine tools as well as the common ones. The action is due to the combined influence of the hydroxide and bichromate, which tends to inhibit and prevent the iron from corroding. The effect wears off in time, of course, but it can be renewed by a further treatment. In fact, occasional treatment at given intervals should render the tools practically permanently immune. The cause of the action is not definitely known. It is thought that the hydroxide acts on account of the OH ions which are freed, and that the bichromate acts to form a protective coat of some sort on the iron, which keeps it from corrosion. This coat cannot be seen, however, even by the aid of powerful microscopes. Since the average worker is more concerned with how it works rather than why, a further discussion of the theory will be dispensed with. The potassium bichromate and the lye can be obtained at any drug store and should be handled with care, since both are poisonous, and one causes burns while the other causes unsightly flesh stains under the condition of moisture on the flesh.—Philip Edelman.

How to Remove Chatter Marks

By William Grötzinger

A SIMPLE method of removing the chatter marks that occur sometimes in lathe work is to grind the tool at an angle, so that its broad edge will keep from falling into the old chatter marks. In the accompanying illustration let the lines *AB* represent the cutting edge of the tool that produces the chattered effect. The chatter marks will then be parallel to the edge of the tool.

Angle of tool for removing chatter marks.

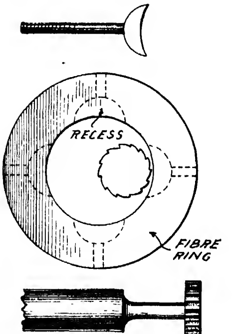
By grinding the tool so that its cutting edge lies in the direction *CD*, the chattered work may readily be removed. This method will be found especially good in turning ironwork.

Improvised Milling Machine

By Louis H. Tolhurst

A SHORT time ago, I found it necessary to replace the fiber in the timer of my automobile. It consisted of a fiber ring about 3½ inches in diameter, about ¾ of an inch thick, and about ¾ of an inch wide. This ring I turned up in the usual way on my small foot-power lathe from an ordinary block of red fiber. When I had done this, I found it necessary to cut four half circles on the inside of the ring, at even distances apart, and about 5/16 of an inch wide, and corresponding in shape to the four steel electrodes which I had removed from the old timer fiber, so that these electrodes could be set in the inner side of the ring, exposing their flat surface flush with the inside surface of the ring.

To accomplish this, I clamped a large cap screw in the chuck and turned the head down to such size and thickness as would exactly fit the cut desired to be made in the ring, turning the shank down to 5/16 of an inch at the same time, as shown in the illustration.



How the lathe was used as a milling machine.

With a half-round file, I cut teeth on the wheel, as shown, being careful to keep the edges of the teeth even with the circumference of the wheel. In this way quickly making an untempered milling wheel the exact size desired to do the work. This took half an hour, no hardening being necessary. The rest was easy. By mounting this little milling wheel in the chuck of the lathe, and clamping the fiber ring with an ordinary wood clamp to the side of a bar of steel mounted in the tool rest of the lathe, the work was done in twenty minutes more, thus using the lathe as a milling machine.

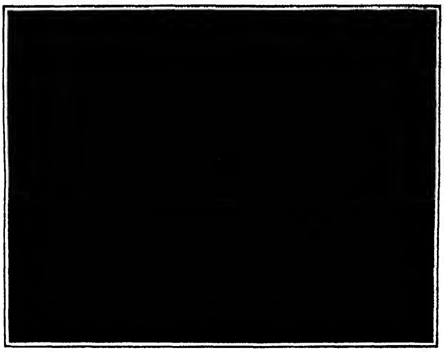
I leave it to the imagination of the reader as to the length of time it would have taken to cut these recesses at all accurately with a cold-chisel. I have since used this little home-made mill to great advantage on wood, hard rubber, babbit, etc., and it has stood up remarkably well; but if the same were made of tool steel and hardened, of course it would serve for a much greater range of uses.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Profile Gage

WHEN a carpenter or cabinet maker wishes to fit a piece of board against a molding, or any other irregular surface, he is apt to find his task a difficult one, unless he happens to have a full-size, cross-sectional drawing of the molding. In order to provide a ready means of producing a profile of the molding, an inventor has designed the gage shown in the accompanying illustration. It consists of two plates of pressed steel fastened together with screws to form the body of the gage. Between these plates a series of wires or thin rods are clamped with just enough pressure to make them hold their positions at various points of adjustment. To facilitate the gripping action of the two plates, their edges are corrugated so as to fit about each rod. The manner in which this gage is used is clearly illustrated. It is merely necessary to press the gage down upon the molding, moving each rod down with the fingers as far as it will go against the molding. When the gage is removed the ends of the rods will form a perfect profile of the molding, and this may be transferred to a board by laying the gage down and drawing a pencil along the profile. The wire rods are each one twentieth of an inch in diameter and every tenth rod is of brass, while the rest are of steel. The brass rods thus divide the gage into half inches, which facilitates measuring an object. Thus the width of the molding can be determined by the gage without the use of calipers.

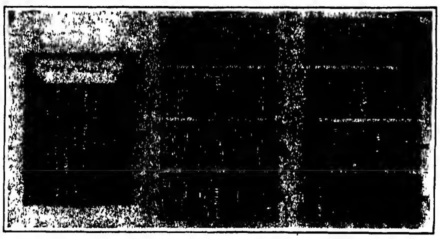


Getting the profile of a piece of molding.

Imitating Cloth Samples With Embossed Paper

NO one who is not directly connected with the business, realizes what a vast sum of money is spent each year by large drygoods dealers in making up samples of their various lines of goods. It is not unusual for a large house to spend twenty thousand dollars on samples for a single line. And frequently over a hundred thousand dollars represents the annual sample bill of a single concern. This may seem incredible, until we understand that large numbers of sample cards must be made up, that yards and yards of material, often very expensive, must be cut into small pieces and be pasted on the cards by hand. These sample cards must go out to drygoods stores all over the country. There are one hundred and eighty thousand of them in the United States, and of these twenty-seven thousand are department stores. Of course, the enormous expense of getting out a line of sample cards for a complete line of goods renders it impossible to supply all these stores with a set of cards. Sometimes it is necessary to start up the mill just to make samples. There are other difficulties. Frequently mistakes are made in pasting the wrong samples on the cards opposite the printed numbers. This will result in the delivery of the wrong piece of goods, and may involve considerable expense.

Recently, an inventor who has had considerable experience in the drygoods business, and also in the lithographing business, conceived the idea of reproducing the samples by making embossed impressions on the card. He devised a method of reproducing the textile fabric so accurately that one can actually count the threads on the embossed paper reproduction by using an ordinary counting glass. Any slight irregularity in the cloth is faithfully reproduced. Even the slightly frayed edges are there. He has shown this work to expert drygoods men, and has completely deceived them into thinking that actual pieces of cloth were pasted on the card. Instead of making up the samples in separate cards, he makes up a complete line in a long folder, something like that of a railroad time table. A portion of one of these folders is shown in the accompanying engraving. On the first page is a piece of the actual material which the buyer may examine critically to test the quality of the line. The different patterns he can select by referring to the samples. As an evidence of the perfection of this embossed reproduction, not only colored samples of cloth are reproduced, but even white goods. Every thread is there and the height of the embossing equals the thickness of the thread.



Sample card with embossed printing in perfect imitation of cloth samples.

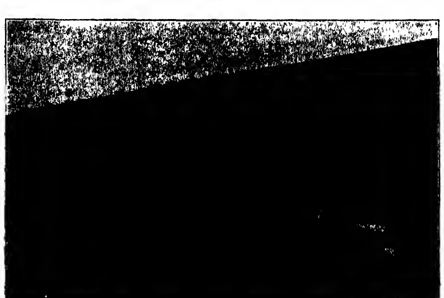
The paper sample card has been adopted by a number of large merchants in New York city, who find that it cuts down their sample bill fully 50 per cent. They do not have to wait for the material from the mills before making up their samples, but can have them reproduced from the design, and they no longer stand in dread of a mistake on the part of the paster. Furthermore, they can have enough cards printed to furnish every drygoods store in the country if they so desire.

Improved Mail Exchanging Device

SO many accidents have occurred in delivering mail from fast moving trains, and there have been so many failures to catch the mail sacks from the roadside crane, that the Post Office Department a few years ago advertised for inventions that would overcome the difficulties. There were many responses to this invitation from the Government, and two or three of the inventions have already received the approval of the Post Office Department. Among them is the one shown in the accompanying illustration. The device was tried out for a full year on the Illinois Central Railroad and was found to give perfectly satisfactory results.

Attached to the train is a metal frame of rectangular form which forms the mouth of a bag made up of chains. This crane is hinged at one side to a pair of bars across the mail-car door, and it can be moved to either side of the door, depending upon the direction of travel of the train; the lower outer corner of the hinged crane is connected by a rod to an extension of the lower cross-bar and bears against a heavy spiral spring. The mail crane at the side of the track has a single arm instead of two as heretofore, and from this two or more mail bags may be suspended. As the train nears the mail crane the iron frame is swung out to catch the mail bag. The shock is taken up by the chains and by the coil spring referred to. The recoil of this spring throws the device back to the car door with the mail sack in the exchange bag and the mail clerk can then readily draw it out without reaching outside the car door. At the roadside a similar crane and chain bag is supported in proper position to receive the mail bags that are suspended from the lower bar of the mail car as shown in our illustration. The only difference between the roadside device and

The train is about to deliver three sacks and receive two.



Positions of the mechanisms after an exchange of mail.

...carried on the train, is that the ...er is larger and much more substantial. During the operation of this ...ce on the Illinois Central Railroad, ...veries have varied from a single ...ch containing a handful of letters to ... sacks and a pouch of 310 pounds in ...ight. Single pouches practically empty ...ve been caught and also pouches ... filled that they could not be strapped ... the middle, as is necessary with the ...d style of hook. All conditions have ...en met with trains running from three ... four miles an hour up to sixty miles ... hour without damage to a single piece ... mail.

At some of the stations where heretofore it has been the practice to make deliveries ten or twelve hundred feet away from the station, the tracks have been spread, and the device has been located between them directly in front of the depot and under the eye of the station agent.

Adjudicated Patents

AMONG the recently adjudicated patents reported in the Patent Office *Official Gazette*, are the Wilfley patent, No. 590,675, for an ore concentrator which was held valid and infringed in Mine & Smelter Supply Company v. Braeckel Concentrator Company; the Claude and Hess patent, No. 664,383, for an apparatus for storing and distributing acetylene gas, limited as to term by the British patent, No. 29,750 of 1896, granted to the same patentees, which expired by limitation June 30th, 1910; also held not infringed in Commercial Acetylene Company v. Searchlight Gas Company; the Lutz patent, No. 839,-071, for a machine for heating surfaces, held invalid; also not infringed if conceded validity in Equitable Asphalt Maintenance Company v. Parker-Washington Company; the Hood patent, No. 858,070, for a burial crypt, held void because the subject-matter is not within the patent law, International Mausoleum Company v. Sievert; the Spahr and Stichler patent, No. 948,-773, for a gas iron, claims 2 and 7 held valid and infringed; Strause Gas Iron Company v. Weil; the Hamilton reissue patent, No. 12,750 (original 619,567), for a face plate for burial caskets, held void in National Casket Company v. Stoltz; the Seeley reissue patent, No. 12,757, for an incandescent lamp socket, held valid and infringed and in Bryant Electric Company v. David Killoch Company, and the Smith reissue patent, No. 13,033 (original No. 759,037), for a lamp, held void as not for the same invention disclosed in the original patent; also held not infringed if valid, Smith Incandescent Light Company v. Welsbach Gaslight Company.

Competition for Miners' Lamps

THE use of portable acetylene lamps has become general in a large number of mines, and this illuminant has definitely replaced the old lamps, oil or otherwise, thanks to its cheapness and the excellent light given by it, and the number of acetylene miners' lamps at present in use can be counted by the hundred thousand. Nevertheless, in spite of various models employed, it does not seem that any of them completely realize all the conditions which a good miners' lamp should fulfill; it is, perhaps, on this account that this application of acetylene is not so universal as it might be. The carbide factories have therefore decided that here they had to find a perfect article, and they have just established an International Competition to this effect, of which the following are the conditions:

Under the auspices of the acetylene unions of the different countries, a competition for acetylene lamps for mines not containing fire-damp is opened from now under the care of the International Committee of Carbide of Calcium, at Geneva. The prize or prizes shall be awarded to the lamp or lamps which most completely fulfill the following conditions: Simplicity and regularity; cheapness; strength and lightness; easiness of upkeep; convenience in cleaning and refilling; difficult to upset; easily handled, and capable of being carried in the hand or being hung on the walls; solid material, light, durable, and unaffected by dampness or the results of the decomposition of the carbide; strong burner of long duration and placed or arranged so as to avoid extinction from dripping water or by mine violences; production of gas as constant as possible; rational generation from the point of view of purity of the gas as well as the yield of the carbide; utilization of the present sizes of carbide; intensity of 5-10 candle-power as far as possible; duration of charge as long as possible. The competition shall be divided into two categories: (1) portable lamps for carrying by hand, duration of charge 8 to 12 hours; (2) portable lamps for carrying on the forehead, of extreme lightness and a duration of at least 4 to 5 hours. At the discretion of the jury, either one or two prizes may be awarded, of a total of 5,000 francs, which may be granted, if two prizes are awarded, as to 3,000 francs for the best portable lamps for the hand, and as to 2,000 francs for the best portable lamps for the forehead. The models, with description, price of re-sale, etc., must be forwarded before March 20th, 1913, to the International Committee of Carbide of Calcium, 5 Rue des Granges, Geneva. The jury will be composed of competent delegates from the different countries nominated by the respective acetylene unions.

Prizes for Electric Mine Lamps

THE British Home Office has published the report of the judges in the competition promoted last year by the gift of $5,000 by a colliery proprietor, which had for its object the encouragement of the production of safe and efficient types of electric lamps for mines. The judges, Charles Rhodes, a former president of the Mining Engineers' Institute, and Charles Merz, a member of the recent departmental committee on the use of electricity in mines, had submitted to them one hundred and ninety-five lamps, and have awarded the first prize of $3,000 to the C. E. A. G. lamp, sent in by F. Farrer, Dortmund, Germany. Inasmuch as a number of other lamps possess considerable merits, the amount offered for competition has been divided into the first prize of $3,000 and eight prizes of $250 each. In an early issue we will publish in the Inventor's Department a brief illustrated article on the prize winner's lamp.

Notes for Inventors

Novel Cup or Hole Rim for Golf Links.—This cup or hole rim, patented, No. 1,041,081, to Howard Hinckley of Washington, D. C., has a cup section and a lower anchor section, one of the sections having a threaded stem and the other helically disposed lugs which form a mutilated thread and by adjusting the connection, the cup may be located properly with respect to the anchor section.

A Drinking Bowl for Horses.—Richard Markley of Norristown, Pa., has obtained a patent, No. 1,042,246, for a drinking bowl for animals in which there is a bowl-shaped body portion and a nozzle projecting upwardly within the bowl and shaped to be taken into the mouth by an animal, the nozzle having a passage through which water passes from the supply and the sides of the bowl project above the top of the nozzle.

Two New Edison Patents.—Thomas A. Edison has secured a patent, No. 1,041,750, for a conveyer in which there are upper and lower runs of a belt and means which receive the material discharged from the upper run and direct it forwardly upon the lower run in the direction of travel of the latter at substantially the same speed as that of the belt. Mr. Edison has also secured a patent, No. 1,041,983, for a phonograph stylus, this patent being assigned to Thomas A. Edison, Incorporated. The invention in this patent includes a stylus for talking machines which is formed of crystallized boron with a rounded point adapted to travel in the groove of the sound record.

Wanted, a Close-fitting Glass Door Knob.—Crystal door knobs of cut or other glass continue to grow in favor. A correspondent calls attention to an objection to this form of mounting in that the connection of the glass with the metal seems in present forms to involve a greater projection from the surface of the door than the metal or similar commercial knobs, and suggests the possibility of so connecting the glass with the metal as to enable the fitting of the crystal knobs as near to the door surface as others. This may necessitate changing the form of the knob itself as well as the method of connection with the metal, but the thoughtful inventor should have no serious difficulty in producing a knob free of the objections above noted.

Touring Accessories.—Now that automobiles have so advanced that they make extended tours more and more desirable, greater attention will be given to the attachments and equipment in the way of facilities for camping out over night, as well as along the culinary line. One has only to consider the sleeping accommodation of the ordinary gypsy wagon to realize the opportunities of even a small car. It is believed that one could devise a simple form of folding cot adapted to be supported upon the front and rear seat backs. The problem would doubtless be more in the means for anchoring the cots in place than in the folding features for close storage, but, possibly, the inventor may combine the features For cooking en route, chafing dishes and other forms of alcohol stoves are convenient, and kits with facilities for using gasoline, the fuel at hand, may find favor.

Operates Alarm Circuit from Vault Lining.—John P. Williams and Herman Huhn of New York city, assignors to Electric Bank Protection Company, have patented, No. 1,041,395, an electrothermostatic lining for vaults, safes, etc, in which the spaced thermostatic conducting plates in layer with lining members, operate when subjected to heat, to actuate an alarm, in an alarm circuit which includes the spaced layer plates.

Electricity Utilized in Cotton Harvester. A San Francisco man, Willie Robert McComb, has patented an improvement in harvesting cotton by which the cotton on the plant is charged with electricity to cause it to expand and a current of electrified air is utilized to remove and harvest the cotton when it has been thus expanded. The patent claims the process and also the harvester in which the process is utilized in the field. The patent is No. 1,041,650.

Muffler for Motor Boat Engines.—Robert Sheldon Strahan of Brooklyn, N. Y., has patented, No. 1,041,190, a muffler for motor boat engines which muffler is in the form of a funnel-shaped chamber attached to the end of the exhaust pipe of the engine with the open end of the chamber to rest slightly below the surface of the water, so that a partial vacuum will be formed in the chamber.

An Elihu Thomson Arc Lamp.—In patent No. 1,041,197 to the General Electric Company, as assignee of Elihu Thomson of Swampscott, Mass., is shown an electric arc lamp in which the lever for operating the arc establishing clutch is actuated by an electro-magnet and means are provided for damping the action of the electro-magnet for reinforcing the bite of the clutch by and in accordance with the action of the electro-magnet.

A New Multi-stage Elastic Fluid Turbine.—The General Electric Company, as assignee of Louis C. Loewenstein of Lynn, Mass., and Leonard H. Dyer of Greenwich, Conn., has secured a patent, No. 1,041,121, for a multi-stage elastic fluid turbine which has a furnace within its shell for reheating elastic fluid between stages, the reheating means being located between the stages and being independent of the generator furnace.

Legal Notes

Assignment Before Issuance of Patent Conveys Only an Equitable Title.—An assignment before the issue of a patent of the entire interest in an invention conveys only an equitable title, and the holder of such an assignment, even though it be duly recorded in the Patent Office, cannot revoke the power of attorney given by the inventor in his application Following an old decision by Chief Justice Taney, the Patent Office has repeatedly sustained this view, holding in one case that where two instruments are recorded in the Patent Office, both of which purport to assign the invention disclosed in an application and only one contains a request that the patent issue to the assignee, the Patent Office, under the authorities, should recognize only the right to prosecute the case of that assignee to whom it is requested that the patent issue, and this to the exclusion of the other assignee The practice is founded upon the principle that prior to the issue of the patent the inventor has an imperfect and inchoate right which he may perfect and make absolute by having letters patent issued to him, and an assignment, including a request for the issue of the patent accordingly, passes the legal title to the assignee, because under it the assignee has, as the inventor had by law, the right to secure letters in his own name.

"Tabloid" a Proprietary Trade-mark.—According to the Oxford English Dictionary, edited by Sir James A H Murray at the Clarendon Press, Oxford, volume ix, published October 1st, 1910, "tabloid" was registered as a trade-mark on March 14th, 1884, in England by Messrs Burroughs Wellcome & Co. for chemical substances used in medicine and pharmacy, and afterward for other goods. The Court of Appeal in England held the term to be a "fancy word" as applied to the goods for which it was registered, and accordingly restricted the use of the term to the preparations of the firm named. "Tabloid" is also a valid trade-mark in this country for similar preparations made by the firm.

Trade-mark Notes

Proof of Infringement.—In the case of Gorham Manufacturing Company v. Schmidt et al., the District Court S D. New York, by Justice Hazel, has held that proof of sales by defendants as dealers of articles bearing infringements of complainants' trade-marks, although to agents of complainants only, together with proof that defendants had other similar articles displayed for sale in their store, is sufficient to entitle complainants to an injunction and that dealers are obliged to be on their guard when buying from manufacturers and to a certain extent are put upon inquiry as to the character of the manufactured product and the manner in which it is labeled or impressed as well as the packages in which it is contained, in order to protect the trade-mark rights of other manufacturers in the same business.

Names of Ex-Presidents not Registrable as Trade-marks.—The present Commissioner of Patents refused some years ago to register the name of ex-President Grover Cleveland as a trade-mark for cigars upon the ground that to use the name of ex-Presidents as trade-marks tends to detract from the high office which they have held and for that reason it was believed to be against public policy for the Patent Office to encourage such use of the names by allowing them to be registered as trade-marks.

Insufficient Use of Trade-mark. In the trade-mark opposition case of Patterson v Hay, it appeared that the only use by Hay of the mark for a liquid binding agent for roads, etc., had been upon a small number of gallon cans of the solution which were shipped as samples. Commissioner Moore held that this use was not such that any trade-mark right could be based upon it and sustained the decision of the Examiner of Interferences in favor of the opposition by Patterson to the application for registration filed by Hay

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT FORM.—E. T. PALMENBERG, 710 Broadway, New York, N. Y. This improvement provides a garment form, more especially designed for fitting skirts, petticoats and like garments and arranged to support pins which can be conveniently removed by the operator for use in fitting the garment.

CONVERTIBLE HOOD, CAPE AND VEIL.—MARION JOHNSTONE, 75 S 5th St., Brooklyn, N. Y. This invention provides a convertible hood cape and veil arranged to form an attractive and comfortable article for the protection of the head, neck and chest in cold weather, or to form a cape, or an accessory, or a trimming, or a veil over the head or hat, or as a sunbonnet for summer use.

Pertaining to Aviation.

LIFE SAVING GARMENT FOR AVIATORS.—J. J. CONFANZO, care of Mons C G Oniatas, Ingénieur 106 Rue Adel Moneim, Alexandria, Egypt. This invention provides a garment adapted for aviators, to prevent injury or death when he or she is dropped with or from an aerial craft. Use is made of an inflatable casing, preferably made of connected sections of rubber or any other inflatable substance with air-receiving apertures therein and means whereby the shock of a fall or blow will be substantially absorbed by the casing and its parts and not communicated to the aviator within the casing.

Of General Interest.

COMBINED EYEGLASS-CASE AND SCREW DRIVER.—H. ASHER, 414 E 187th St., Bronx, N. Y., N. Y. The object here is to provide a combined eyeglass-case and screw-driver, of which the case is adapted to carry eyeglasses in the usual manner, and the driver is mounted on the case to permit convenient removal thereof for repairing the eyeglasses in case of need.

NON-METALLIC BEARING.—C. O. L. CARDELL, Pearl River, N. Y. This invention provides a bearing, pulley bushing and like articles, formed of wood and so treated that the fibers are hardened, and the wood is permeated with a special lubricant and preserved, to render the article exceedingly serviceable for use in spinning and other machines, especially as constant oiling can be dispensed with.

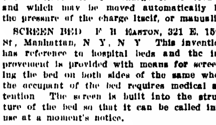
PIANO HAMMER.—J. W. E. LAKER, Box 103, Victoria, British Columbia, Canada. This invention relates to hammers for pianos and other stringed instruments, and more particularly to the socket or joint connecting the head with the shank of the hammer. An object is to provide a joint or socket, whereby a new head may be readily applied to the shank of the hammer without interfering with the rest of the mechanism.

DEVICE FOR COOKING COTTON SEED OR LINSEED MEATS.—C. H. FULSON, Memphis, Tenn., care of J. W. Todd, New Orleans, La. An object here is to provide a device having a series of retainers, each provided with a movable cover, which may be held in close contact with the charge to be cooked, and which may be moved automatically by the pressure of the charge itself, or manually.

SCREEN BED.—F. B. EASTON, 321 E. 15th St., Manhattan, N. Y., N. Y. This invention has reference to hospital beds and the improvement is provided with means for screening the bed on both sides of the same when the occupant of the bed requires medical attention. The screen is built into the structure of the bed so that it can be called into use at a moment's notice.

MOTOR BOAT.—J. D. MULLER, 120 Martense St., Brooklyn, N. Y., N. Y. Certain improvements in this propelling apparatus comprise in effect a series of paddle blades mounted upon an endless chain which carries the paddle blades successively into engagement with the water, to move the boat forward.

FINGER CUFF.—C. C. HADRICK, care of Swift & Co., Kansas City, Kan. More particularly the invention comprehends a shackle adapted to be secured on any finger on either hand, the device being especially intended to prevent escape. The principal purpose is to provide a finger cuff made up of parts in which



FINGER CUFF.

the finger is positioned, the parts being movable relatively to each other and being adapted to be held in such removed position whereby movement of the finger or straightening thereof is prevented. The engraving herewith shows a perspective view of the device in operative position on the index finger.

LOCK FOR BASCULE BRIDGES.—H. C. KRASS, 1739 Spalding Ave., Chicago, Ill. The main object here is to provide a device in which the strains are taken up by the lock and one which is easily manipulated so as to permit the bridge to open. It provides locking means of great power for forcing the heel of the counterweight tightly against the bumping block so as to prevent any movement of the bridge while in use.

SIPHON VALVE FOR FLUSHING TANKS.—J. J. MEYER, 336 Lenox Ave., New York, N. Y. This invention relates to discharge valves of flushing tanks for water closets, urinals, and other similar features, and the aim is to provide a valve for permitting a full or only a partial discharge of the water in the tank from above the normal level of the water in the tank; to provide means for the escape of overflowing water from the leakage of valve cocks; and to prevent waste of water by leakage or other causes.

Hardware and Tools.

COIN-CONTROLLED LOCK.—D. W. WOOD, care of McNutt & Shattuck, 12 Knight Block, Brazil, Ind. Mr. Wood's invention relates to a coin-controlled lock, and more particularly to locks on doors to rooms, to enter which a charge is made. It provides a lock in which the coin will remain in view after the door is unlocked and will remain in this position until the door is opened from the inside.

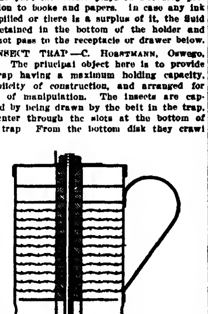
COMBINED SEAT DRESSER AND CUTTER HOLDER.—W. KAISER, 153 So. Main St., Wilkes Barre, Pa. This tool provides for always having a plurality of cutters with the dressing-tool, which may be readily attached to and detached from the dressing-tool and stored in the receptacle. There is thus no danger of losing the cutters, and the dressing-tool has been so modified as to combine therewith a suitable receptacle which alters its structure, but co-acts therewith to obtain a definite result.

DOOR CHECK.—E. W. CLARK, 617 2d Ave., South, St. Petersburg, Fla. The intention here is to provide a simple and inexpensive construction and arrangement of parts whereby to provide a door check which will be efficient in use and possess strength and durability, and in which the tension may be readily regulated.

SHOE JACK.—F. MELLEN, North St., between Union Place and Wyckoff Ave., Brooklyn Hills, New York, N. Y. This inventor's aim is to compensate for the wear on the sole during the period of wearing the shoe. An object also is to restore the resiliency, elasticity, strength and stiffening to the soles under the instep, and to afford an improved resting place for the ball of the foot.

HOLDER FOR INKWELLS.—C. KRICKE, 111 W. 3d St., Beardstown, Ill. This invention provides means to hold an inkwell now commonly used in school desks, and to so position the well as to bring its top below the surface of the desk top, thereby preventing the spilling and spreading of ink on the top of the desk. An important feature of the invention is the part the holder plays in affording protection to books and papers. In case any ink is spilled or there is a surplus of it, the fluid is retained in the bottom of the holder and cannot pass to the receptacle or drawer below.

INSECT TRAP.—C. HORSTMANN, Oswego, Ore. The principal object here is to provide a trap having a maximum holding capacity, simplicity of construction, and arranged for ease of manipulation. The insects are captured by being drawn by the bait in the trap, to enter through the slots at the bottom of the trap. From the bottom disk they crawl



INSECT TRAP.

successive wire disks. Somewhere in their climb prior to reaching the topmost disk where most of the bait is deposited the insects are overcome and die. The engraving inserted herewith shows a vertical section of the trap.

DOOR CHECK AND HOLDER.—H. A. GUSTAFSSON, care of J. V. Addis, Nausori P. O., Rewa River, Fiji Islands. This improvement is in means for retaining in an open or partially open position, a door, gate, window or other swing closure, and has in view a catch which will operate automatically to engage the door or other closure when the latter is sufficiently thrown open, and hold the same from closing until purposely released.

DOOR OR WINDOW LOCK.—V. J. DANIELS, 191 Walker St., New York, N. Y. This device is for use in securing a window, door or other movable object in any desired position. Such devices are used for locking a door or window shut when the same is not furnished with regular locks, and an object here is to provide a device which may be easily carried in the pocket or suitcase when away from home.

FASTENING DEVICE.—R. V. SAMPSON and S. T. DANLEY, Room 17, 1642 Champa St., Denver, Colo. The invention relates generally to fastening devices and more particularly is directed to a structure which is especially adapted for securing the lines from the bridle bit or halter of a horse in order that the animal may be hitched to a suitable post or other support.

Machines and Mechanical Devices.

APPARATUS FOR MAKING TOOTHED GEARING.—F. HUMPHRIS, Barton Peverll, Eastleigh, England. The present invention relates more particularly to generating apparatus for use in the production of the operative surfaces of the helmet-shaped teeth and correspondently shaped recesses or holes constituting the generated elements in the well-known "Humphris" type of gearing in U. S. Patent No. 859,662, and U. S. pending application Serial No. 467,154.

TOOTHED GEARING.—F. HUMPHRIS, Barton Peverll, Eastleigh, England. This invention relates to apparatus for producing the operative surfaces of the so-called "generated" motion-transmitting elements in gearing wherein the operative surface of a motion transmitting element in one member is produced by the generative action of a rotary cutter having an effective profile which represents the operative surface of the coacting element in the other member of the gearing. It relates more particularly to the apparatus in U. S. Patent No. 859,662 and U. S. pending application Serial No. 467,154.

APPARATUS FOR MAKING CONFETTI.—G. G. GRIFFIN, 65 Wall St., New York, N. Y. This machine makes confetti by cutting up a sheet of paper or cardboards having perforations therethrough arranged in rows. The perforations may have various shapes, and when the paper is cut up, it is divided along lines joining the centers of the perforations of each row in one direction and other lines at angles thereto.

ASSEMBLING MACHINE.—GEORGE A. ENSIGN, care of Defiance Machine Works, Defiance, Ohio. This assembling machine is more especially designed for assembling the sections of wooden wheels such as are used for automobiles and other vehicles, the machine being arranged to insure an accurate and quick assembling of the wheel parts with a view to form a true wheel and to provide the wheel parts with a false or a temporary hub to hold the parts together until a tire is placed on the rim.

SCRAPER ATTACHMENT.—G. E. TUCKER, Springwater, N. Y. The invention relates to road grading machines, and particularly to attachments for scrapers and an object is to provide a structure which will permit the scraper to readily pass over obstructions without injury to the machine or the scraper.

CUT OFF FOR BOX COVERING MACHINES.—A. BELL, 103 Beach St., Jersey City, N. J. The improvement is in cut offs for box covering machines or the like, and the purpose is to provide a structure whereby the cutting knife will automatically disengage itself and when worn may be adjusted for presenting a substantially even cutting surface.

REDUCING VALVE.—S. A. STINSON, 751 Amsterdam Ave., New York, N. Y. The more particular purpose of this inventor is to provide a valve having a great variety of uses and being of simple structure and also being capable of handling the flow of liquids in large quantities as well as in high, low or varying pressure.

AUTOMATIC WATER LIFT.—G. A. FERGUSON and A. MARSHALL, Condon, Ore. The invention pertains generally to devices for lifting water and more particularly it involves means whereby a vacuum may be obtained in any suitable vessel communicating with a well or cistern whereby atmospheric pressure may force water from the well or cistern into a vessel.

LINE CARRIER.—L. D. SHAFFER, Scalp Level, Pa. This invention is an improvement in line carriers, such as shown in Mr. Shaffer's prior patent, and like the construction shown in said prior patent, is especially intended for use in stringing wires after the first wire has been strung, as well as for carrying the wires, lines, etc., across an intervening space having a wire for supporting the device.

Prime Movers and Their Accessories.

FLOW MOTOR.—O. C. MOORE, Morrow, Ohio. This device supplies fuel to a steam generator in proportion to the water supplied to said generator, and is what is commonly known as a flow motor; and is adapted for use in connection with the invention disclosed in Mr. Moore's application for a feed water and fuel control.

INTERNAL COMBUSTION ENGINE.—A. F. CRUIKSHANK, 364 8th Ave., Grand Rapids, Mich. This engine has a pair of oppositely directed arms secured to a common shaft [illegible] with means for exploding charges [illegible] on one side and an abutment head and [illegible] on the other side, and a second head [illegible] the joint effect of the simultaneous [illegible] causes an oscillating movement of the arms, thereby doubling engine efficiency.

Railways and Their Accessories.

SLIDING DOOR LOCK.—H. V. C[illegible]HAM, Rensselaer, and G. O. PRICE, 331 W[illegible] St., Albany, N. Y. For the purpose of the invention use is made of a track on the side of the car, hangers fastened to the car door and provided with hooks engaging the track, rollers journaled on the hangers and mounted to travel on the track, and manually controlled wedges adapted to be forced between the rollers and the track to firmly engage the hanger hooks with the track and thus lock the door in open, closed or partly open position.

RAILWAY ROAD BED.—J. O'GORMAN, San Luis Obispo, care of A. L. Dutton, 75 Higuera St., Obispo, Cal. This inventor has devised an improved construction of block and provides the same with metallic chairs adapted to receive and support rails, and has also connected the opposite blocks by means of adjustable metallic ties.

RAILWAY SWITCHING APPARATUS.—G. CAMPANA, Manhattan, N. Y., N. Y. This apparatus is for use on railways of all kinds, and is adapted to obtain results without stopping the car or train in order to throw the switch, or even to slow down when the switch is approached, and it is not necessary to have a switchman or other track attendant on duty at the switch at the instant the car or train is passing.

RAIL BRACE.—A. R. DAVIS, 8 Cemetery St., Oneida, N. Y. This improvement has reference generally to rail braces and more particularly is directed to a construction adapted to extend between and engage both rails of a track whereby the spreading of the same, due to lateral pressure, may be prevented.

Pertaining to Vehicles.

METALLIC WHEEL.—S. H. SUMMERSCALES, Box 1891, Winnipeg, Manitoba, Canada. This invention consists primarily of a metallic wheel having flat spokes attached to the sides of a channeled hub, and channeled tire. Between the two sets of spokes reinforcing means is provided, in order to set forth a wheel of great strength which calls for a small amount of material.

SHOCK ABSORBER FOR ROAD VEHICLES.—A. W. CHAPMAN, 27 Westfield road, Acock's Green, Birmingham, England. This absorber consists mainly of a volute spring, over whose bottom convolution is slipped a plate by which the spring is secured in position with means to effectively grip the splayed-out position of the spring without the latter projecting beyond the lower face of the plate. Into the spring's upper convolution a head of wood, rubber, metal or fiber is inserted. Means are provided which expand the slit portion of the head and by its expansion tightly against the inner side of the upper convolution causes the head to be firmly secured in position.

Designs.

DESIGN FOR A HANDLE.—T. F. CURLEY, 318 Broadway, N. Y., N. Y. This ornamental design is of a stropping handle for any make of safety razor blade. The concave place or thumb seat and the back of the handle are made so as to get the right angle to strop a blade correctly.

DESIGN FOR A BANNER.—A. B. VAN RIPER, care of Frost & Van Riper, Paterson, N. J. This ornamental design for a banner is V-shaped, the main and interior portion being solid black on which in white appears Wilson mottoes and a picture of the "White House." A white border contains repetitions of a shell and oarsman with the words "Wood Row" over each.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12699) P. N. R. asks for information concerning artificial whalebone. A. 1. This material is easiest made from raw animal skins. These are first treated with sulphide of sodium and the hair removed. The skin thus prepared is placed for 24 to 36 hours in a weak solution of bichromate of potash. To dry the skin thus prepared, it can be stretched or tacked on a frame, a flat plate, or any similar contrivance, so that in drying the skin cannot shrink, and to insure its drying as flat as possible. On these frames the skin, exposed to the effect of daylight, is dried, at first slowly, and then exposed to a temperature of 122 to 140 deg. Fahr. The action of the daylight, in combination with the bichromate of potash the skin now contains, makes the glue present in the skin cells insoluble in water, and prevents the occurrence of putrefaction, while the vigorous drying removes the moisture from the innermost core of the leather. The dried skin is then compressed under very heavy pressure, and the material thus obtained possesses a hardness and elasticity closely approaching that of the genuine whalebone. This material, before or after drying, can, by coating, or immersion in a bath of color, be colored as desired in order to impart to it the color of the natural whalebone. It is made better capable of resisting moisture by coating or impregnation with rubber, varnish, lacquer, or similar substances. Where rubber is used, it can be either applied directly or in the form of a casing or covering, drawn over each piece or rod. The separate rods may also be protected from moisture by inclosure in waterproof paper or waterproof fabric. This artificial whalebone can also be made from more or less tanned leather, which, for this purpose, is treated like the untanned skin. When the artificial whalebone is completed it is cut into plates of any desired length and width. The product may also be given a rounded form by pressing. 2. Ordinary rattan is freed from its smooth, glazed exterior covering in a special machine, and by means of a decoction of Campeachy wood and an iron stain, dyed black. When dry it is saturated with a solution of caoutchouc, gutta percha and sulphur in coal-tar oil. After this the rods are steamed in a steaming apparatus under a pressure of two atmospheres, whereby the mixture with which the cane is impregnated is thoroughly hardened (vulcanized), and finally they are passed between rollers whereby they are made absolutely dense and highly elastic. 3. Caoutchouc, 1 part; shellac, 0.2 part, magnesia, 0 2 part; sulphur, 0.25 part; golden sulphur, 1.25 parts The caoutchouc (India rubber) must be cut up very fine and then kneaded in with the other ingredients at a steadily rising temperature, which, however, must not be allowed to rise above 284 deg. Fahr. Rattan, split into fine strips, is treated in the hot mixture for several hours 4. Cane strips, saturated with a solution of nitrate of iron, Campeachy wood and vitriol, treated with linseed oil varnish, and finally polished. 5. Suitable fibers, such as piassava, alfa, Mexican fiber, etc., are saturated with a solution of silicate of soda, either alone, or mixed with baryta, felspar or chalk, or with any glue, cement, gum, etc. The mass is cut into strips and dried Hereupon it is covered with a coating that dries in the air, such as glue, shellac, celluloid, etc., also with caoutchouc solution, copal, etc.; finally it is wound spirally with a covering of silk, etc. For brushes or brooms, the thin, short fibers are used, *saturated with arosin solution.*

(12700) G. W. asks for formulas for embalming fluids. A. The following is a formula for the embalming fluid approved by a committee of the National Funeral Directors' Association of the United States: Solution of formaldehyde, 11 pounds; glycerine, 4 pounds; sodium borate, 2½ pounds; boric acid, 1 pound; potassium nitrate, 2½ pounds; solution of eosin, 1 per cent, 1 ounce; water, enough to make 10 gallons. The sodium borate, boric acid and potassium nitrate are dissolved in 6 gallons of water; the glycerine is added, then the solution of formaldehyde, and lastly the solution of eosin, and the necessary amount of water.

Merell's Antiseptic Liquid.—Arsenious acid, 14 ounces; caustic soda, 7 ounces; water, 20 ounces, carbolic acid, sufficient to render the fluid, after stirring, opalescent; then add water enough to make 100 ounces. Mix well.

Modern Formulas. 1. Salicylic acid, 4 drachms; boric acid, 6 drachms; potassium carbonate, 1 drachm; oil of cinnamon, 4 drachms; oil of cloves, 3 drachms; glycerine, 5 ounces; alcohol, 12 ounces; hot water, 12 ounces. Dissolve the first three ingredients in the water and glycerine, the oils in the alcohol, and mix the solutions. 2. Thymol, 15 grammes; alcohol, ½ ounce; glycerine, 10 ounces; water 5 ounces. 3. Potassium nitrate, 40 grammes; potassium carbonate, [illegible] grammes; glycerine, 1,000 cubic centimeters. Success in the use of any embalming fluid depends largely on manipulation, an important part of the process being the thorough removal of fluid from the circulatory system before undertaking the injection of the embalming fluid.

NEW BOOKS, ETC.

History of Bridge Engineering. By Henry Grattan Tyrrell, C.E. Chicago: Published by the author, 1911. 8vo.; 479 pp.; illustrated. Price, $4.

Artistic Bridge Design. A Systematic Treatise on the Design of Modern Bridges According to Æsthetic Principles. By Henry Grattan Tyrrell, C.E. Chicago: The Myron C. Clark Publishing Company, 1912. 8vo.; 300 pp.; 150 illustrations. Price, $3.

The author calls attention to the fact that the history of bridge engineering is generally slighted in the schools, partly from a failure to realize its practical importance, partly from lack of works on the subject. In approaching problems in any art or science, incalculable time and effort may often be saved by a knowledge of what has been done in the past. This history condenses the experience of ages into a text-book of moderate size. Out of some two thousand pictures and designs, 330 were finally chosen to illustrate the work. From the bridges of Egypt and of Rome, through the constructions of the mediæval and renaissance periods, the author leads us to the discussion of modern stone bridges, pontoons, aqueducts, bridges of wood, cast iron, solid and reinforced concrete, with chapters devoted especially to suspension and cantilever bridges. In "Artistic Bridge Design," Mr. Tyrrell urges greater attention to the artistic treatment of bridges, and endeavors to supply the essential knowledge and the primary training necessary to develop taste and judgment. His examples are well selected, his arguments well presented. The many fine illustrations of American bridges show that it is the utilitarian principle carried to extremes, and not any lack of talent in our native bridge architects, that is responsible for the numerous grim, repellent skeletons that straddle our busy waters.

Der Panamakanal. Die Bedeutung des Kanalbaues Seine Technik und Wirtschaft. Von Dipl. Ing. Max D. Fiegel. Mit 16 Abbildungen im Text und einer Übersichtskarte. Dietrich Reimer (Ernst Vohsen) in Berlin.

This book on the Panama canal has been written ostensibly for the purpose of placing before the German exporter a clear account of the construction of the Panama canal and of the business significance of a waterway which will have a tremendous bearing upon his export trade. The author writes of the Panama canal evidently from personal inspection and knowledge. He discusses first the Panama situation up to 1901, and then proceeds to describe the character of the country through which the canal passes, the merits of a sea level or lock canal, the manner in which the canal is being built, transportation facilities of the Isthmus, the various dredges and other machines used for wet excavation, and the operation of the canal when it is finished. So much for the section on the mechanical construction of the canal. The commercial section of the book deals with the administration of the Canal Zone by the United States, as well as the industrial, political, and military significance of an Isthmian waterway On the whole, this may be regarded as the best popular book that has appeared in Europe on the subject of the Panama canal.

The Great Star Map. Being a Brief General Account of the International Project Known as the Astrographic Chart. By H. H. Turner, D.Sc., D.C.L., F.R.S. 159 pp. New York: E. P. Dutton & Co., 1912.

In this little book Prof. Turner has given us what may well be considered a model of popular astronomical writing. He has told plainly and simply the nature and the importance of the huge photographic catalogue which is now being published in different ways by different observatories. The subject offers no chance for startling writing, no chance for playing upon the reader's dramatic sense; yet Prof. Turner has produced a wonderfully interesting volume that will be read with pleasure and profit by the amateur astronomer in particular.

The Boy's Playbook of Science. By John Henry Pepper. Revised by John Mastin, M.A., D.Sc., Ph.D. New York: E. P. Dutton & Co., 1912. 8vo.; 680 pp.; illustrated. Price, $2.50 net.

Years ago, when our old boys were young, the popularized science of John Henry Pepper furnished them with many an hour of recreation and instruction. Now one of his books, "The Boy's Playbook of Science," comes to us with a fanfare of trumpets as "revised, rewritten, and reillustrated, with many additions." A perusal of the reviser's preface leads one to expect great things, but on close examination it is found that the new edition is nothing short of an imposition upon an unsuspecting public. There are a few pictures of aeroplanes and a page or two of futile description; two pages of drawings of the modern locomotive; brief mention of radio-activity and wireless telegraphy; and some poor illustrations of the turbine. These seem to be all the additions worth noticing. The preface epitomizes the faults of the volume. It consists of unfulfilled promise, perfervid exhortation to the youth of England, and a rather ludicrous and bewildering comparison of a rope-dancing monkey with the boy and his "God-like attributes." Throughout, the work is couched in that ponderous, uninteresting language affected by pedants of the old school. The saddest parts are those where the shadow of some humorous reference has fallen across the mind of the writer without focusing itself clearly, and the result is that saddest of all sad things, a joke that is not a joke. However, we must do the book the justice of saying that it avoids for the most part even the suspicion of jocularity, taking itself with a labored seriousness. A great many old and obsolete pictures encumber the work without adding to its value. As a case in point may be cited the steam gun, to which space has been devoted wholly incommensurate with any lesson it may now have to impart. In short, it is inconceivable that the new edition should appeal with any degree of success to the American boy, who has at his command timely works in simple and absorbing language, yet even more authoritative and instructive. The whole tone and tenor of the volume is that of an outlived past, with all the faults of antiquity and little of its charm The boy of to-day has been educated to expect something entirely different, and he is entitled to get it.

The Business of Mining. A Brief Non-technical Exposition of the Principles Involved in the Profitable Operation of Mines. By Arthur J. Hoskin, M. E., Consulting and General Mining Engineer. With 16 full-page illustrations and 1 chart. Philadelphia: The J. B. Lippincott Company, 1912.

Probably no form of stock-jobbing has been so debased as that of selling mining securities. The result has been that deposits which might be worked with great profit if the necessary funds were only forthcoming, must occasionally be held for years, until a favorable opportunity presents itself for the formation of a company by honest men. Obviously a book is needed which will give the investor an insight into mining, and which will show what forms of mining may be followed as a business, with just as much assurance of success as that which attaches to any one of the many lines of industrial activity This purpose Mr Hoskin has admirably fulfilled in writing the volume that lies before us Nothing of a technical or engineering sort has been attempted, his sole aim being to establish the reliability and the credit of the mining industry, as a whole by pointing out the lines of conduct which should be followed by those who enter its precincts as business people.

Elementary Entomology. By E. Dwight Sanderson, Dean of the College of Agriculture, West Virginia University, and C. F. Jackson, Professor of Zoology in New Hampshire College. New York: Ginn & Co., 1912. Price, $3.

In their preface the authors assure us that this book is the result of an effort to furnish a text-book for beginners The economic side of the subject has been made the dominant note in the book and the forms discussed are mostly those of economic importance. Believing that the subject matter of a course in entomology should be not a discussion of the common injurious insects, as commonly supposed, but rather a knowledge of the structure, habits, and classes of insects in general, the authors have given us a book in which the more important phase of entomology for academic study is presented.

A Handbook of Testing Materials. By C. A. M. Smith, M.Sc. New York: D. Van Nostrand Company, 1911. 8vo.; 284 pp.; illustrated. Price, $2.50 net.

Written primarily for the student, this work may be read with benefit by the working engineer It discusses the general properties of materials, illustrates and describes the machines used in tension, compression, and bending tests, explains strain-measuring instruments and their use, and summarizes methods and results. It deals also with the testing of cements, reinforced concrete, stone, and timber, and presents experiments suitable for the college laboratory. Appendices include recent researches that will be of interest to the advanced student. In addition there are tables of useful constants and a bibliography. The plates constitute a valuable aid to an intimate grasp of the subject.

Bromide Printing and Enlarging. New York: Tennant & Ward, 1912.

Developers and Development. New York: Tennant & Ward, 1912. 12mo.; paper covers. Price each, 25 cents.

"Bromide Printing and Enlarging" takes up the choice of bromide paper, the question of light and illumination, paper negatives, enlarging both by daylight and by artificial light, and the reduction and toning of bromide prints and enlargements. "Developers and Development" discusses negative making, developing agents, and chemical manipulation. The best-known developers are analyzed and their distinguishing characters made known, with instructions for their most advantageous use in negative making.

Forecasting Weather. By W. N. Shaw, F.R.S., Sc.D. New York: D. Van Nostrand Company, 1911. 8vo.; 380 pp.; illustrated with maps, charts and diagrams. Price, $3.50 net.

In a most interesting introduction, Dr. Shaw tells us how he came to watch the routine of forecasting from the point of view of experimental physics; and in this work he brings "the physical laboratory and the daily weather into harmony" Dr. Shaw is confronted at the outset of his work by great difficulties due to double standards of measurement—the metric and the popular. He seems to have done the best possible thing under the circumstances, and his preliminary chapter on units clears the way to intelligent discussion. As to plan, the work first explains and illustrates the construction of the synoptic chart, and its use in forecasting The physical processes involved in weather phenomena are given a careful examination Subsequent chapters present special phases of the work of forecasting—gales and storm-warnings, anticyclonic weather, land and sea fogs, and forecasts for aeronauts Recent developments in practice, as put forth by such authorities as Ekholm and Guilbert, receive due attention, and there is a chapter on statistical methods for long-period and seasonal forecasts

The United States Patent Office By E. C. Moore, Commissioner of the United States Patent Office. Reprinted from Vol. IV, 1911, of the transactions of the American Institute of Chemical Engineers.

Although this paper was intended primarily for chemical engineers, it contains matter, that should be of interest to every inventor manufacturer, and scientific man who comes into contact with the Patent Office directly or indirectly Commissioner Moore has here succinctly pointed out the needs of the Patent Office, and made a strong plea for the use of the millions already collected from inventors for the improvement of the patent service

Anthropology. By R. R. Marett, M A. New York: Henry Holt & Co., 1912. 16mo.; 256 pp. Price, 50 cents net; by mail, 56 cents.

Prof. Marett's definition of anthropology is "the whole history of man as fired and pervaded by the idea of evolution" The race problem as stated, the influence of environment traced, language and its development forms a pleasing chapter, and essays on social organization, law, religion, and morality lead up to an epilogistic study of man as an individual The book is from the new "Home University Library of Modern Knowledge"

Jane's Fighting Ships. 1912. Fifteenth Year of Issue. Published and edited by Fred T. Jane With a Special Chapter on the "Progress of Marine Engineering," by Charles D. Sells, Member of the Institute of C. E. Sampson, London Lowe, Marston & Co., Ltd.

Jane's "Fighting Ships" is familiar to everyone who is interested in naval matters the world over During its fifteen years of issue this work has grown by steady increment, and the volume before us is a veritable compendium of naval information closely compacted within 550 pages The book is undoubtedly the most exhaustive compendium of naval information of its kind, and it is just that kind of information that practical naval men and laymen who take a technical as well as a general interest in naval affairs are looking for Every navy in the world is described The work includes for each navy a series of silhouettes of every important ship, maps of the leading harbors and naval stations, an outboard profile and deck plans of every important warship in which the guns and armor their dimensions, calibers, thickness, etc , are shown, a half-tone of every important ship Full details as to horse-power, speed, trial speed at sea, the character of the machinery, the name of the builders, etc , are given for each ship Also, for each navy there is given a table of the guns, with weight of powder charge, shell, gun, etc and the penetrating power. Of great value is the article by C. DeG Sells on the "Progress of Warship Engineering," in which the very latest developments are illustrated and clearly explained Also naval enthusiasts will be greatly interested in an article on the "Battleship of the Future," by Gen Cuniberti, chief constructor of the Italian navy, who, it is claimed, was the first to draw up plans for an all-big-gun battleship.

Index of Mining Engineering Literature. By Walter R Crane, Ph.D. New York. John Wiley & Sons, 1912 8vo.; 445 pp Price, $4 net.

This issue of the index covers the same ground as the first volume, with the addition of a number of new publications It is especially commendable for its system of cross-references and multiple references, and for its wealth of material on the subject of cost, which covers almost every phase of mining and metallurgical practice These desirable features will be appreciated by the practicing engineer The facility with which the list may be consulted, and the ease with which authorities may be found, cannot fail to appeal to the consulting reader, while the publications referred to are for the most part Journals, reports of societies, and magazines which may be obtained quickly and at small expense.

Strength of Materials. A Text-book for Secondary Technical Schools. By Mansfield Merriman. New York: John Wiley & Sons, 1912. 12mo.; 169 pp.; illustrated. Price, $1 net.

Students in the higher classes of manual training schools have been kept particularly in mind in the preparation of this work, and the lessons are so presented as to dispense with the calculus, and to require only a knowledge of arithmetic, algebra, geometry, and elementary mechanics. Rules are given for the study and the designing of common beams by simple algebraic and geometric methods. The fifth edition added a chapter on reinforced concrete, while this, the sixth edition, presents a new chapter on combined stresses and introduces many new problems.

Canada. By A. G. Bradley. New York: Henry Holt & Co., 1912. 16mo.; 256 pp. Price, 50 cents net; by mail, 56 cents.

A Proverb of Bell Service

Once upon a time there dwelt on the banks of the holy river Ganges a great sage, by name Vishnu-sarman.

When King Sudarsana appealed to the wise men to instruct his wayward sons, Vishnu-sarman undertook the task, teaching the princes by means of fables and proverbs.

Among his philosophical sayings was this:

"To one whose foot is covered with a shoe, the earth appears all carpeted with leather."

This parable of sixteen hundred years ago, which applied to walking, applies today to talking. It explains the necessity of one telephone system.

For one man to bring seven million persons together so that he could talk with whom he chose would be almost as difficult as to carpet the whole earth with leather. He would be hampered by the multitude. There would not be elbow room for anybody.

For one man to visit and talk with a comparatively small number of distant persons would be a tedious, discouraging and almost impossible task.

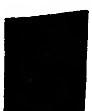
But with the Bell System providing Universal Service the old proverb may be changed to read:

To one who has a Bell Telephone at his lips, the whole nation is within speaking distance.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

Every Bell Telephone is the Center of the System.

Trade Marks
Trade Names



Do you use a Trade Mark?
Do you own the Trade Marks you use?

You should read this booklet to obtain a definite and clear conception of Trade Mark rights

A TRADE MARK is a most valuable business asset. It will pay you to know how such marks are made valuable, and why and how they are protected. The registration of trade marks is explained in this booklet, which gives a thoroughly comprehensive idea of the requirements for registration. The elements of a good trade mark are fully discussed, and many tests to determine the requisites of a desirable trade mark are given.

The booklet is printed in two colors and is illustrated by fifty engravings

Send twenty-five cents today for a copy

MUNN & COMPANY, *Solicitors of Patents*
Branch Office, Washington, D.C. 361 BROADWAY, NEW YORK

The Mining of Herculaneum

(Concluded from page 421.)

who continued, no doubt, to make the villa at Herculaneum their summer home. They nursed literary ambitions. Their ancestor, Lucius Calpurnius Piso Cæsoninus, seems to have been no better or worse than the average grafting Roman governor *in partibus*. One conceives him as a mild rival of the notorious Verres, who left no marvel of art in all Sicily unlooted while governor of that island, according to Cicero's account of him. It is charitable to suppose that Piso was satisfied to purchase the art treasures and the collection of manuscripts which he conveyed to his Herculanean villa, on the way home from his foreign service, probably at Athens. Several of his bronzes have Greek inscriptions on them, and one of them, which is a copy of the famous Spearman of Polykleitos by a late Athenian statuary, bears the latter's Greek signature, *Apollonios, the son of Archias*. Only two per cent of the 800 manuscripts discovered in the Villa of the Pisones are Latin, all the others are Greek. It is from these that the antique mansion takes its best name, *The Villa of the Papyrus Rolls*.

The Pisones, if indeed they owned this private gallery of sculpture, and library, possessed many fine portraits of Greek literary and other heroes, both in marble and bronze. There is a marble one of the tragic poet Euripides. The Pisones were playwrights themselves. Alexander the Great on horseback, and again, perhaps, on foot, is the subject of two exquisite bronze portrait statuettes. The Pisos had two bronze busts of Demosthenes. The inscribed one has served to identify all the extant portraits of that eloquent patriot, from the famous Vatican statue down. It adorned the library of the Herculanean house, together with several other inscribed bustlets of the leading Epicurean philosophers Another portrait, of great energy, was named Piso by Comparetti. Others called it Seneca. It is the head, most likely, of some late Greek poet. Still another bronze, which was formerly called Plato, is evidently a bearded Bacchus.

The decipherment of the charred papyrus rolls themselves has revealed the predilection of their first purchaser for the doctrines and writings of one philosophical sect, the Epicurean. To tell the plain truth, Piso's library is a horrible disappointment. Instead of lining his pigeonholes with great literature, on the pattern of President Eliot's five-foot shelf, this retired statesman read contemporary philosophy. His favorite authors might have been half a hundred lost Greek poets. They prove to have been the sort of people we used to call divines! The resurrection of Lord Byron's theological bookshelf in the year 2500 would scarcely provoke many shouts of joy. Witness the lines he wrote himself.

> "Much English I cannot pretend to speak,
> Learning that language chiefly from its preachers
> Barrow, South, Tillotson, whom every week
> I study, also Blair, the highest reachers
> Of eloquence in poetry or prose.
> I hate your poets, so read none of those." [1]

Still, there are fragments of a speech by Hypereides, the man who procured the beautiful Phryne's acquittal by unveiling her charms to an Athenian jury, and an essay by Epicurus, and a readable treatise on music by a certain Philodemos.

The labor and the risk of opening these fragile rolls is incredible. I saw a trained reader undo one under glass at Naples. Two silk ribbons held a film of collodion in process of formation. Sections of the charred writing were persuaded to adhere to this light foundation, as a clockwork slowly, slowly unwound the moistened volume. The reader must copy the surviving syllables as best he can, from his black on black model.

The decipherment and the publication of the Herculanean texts, of the *Volumina Herculanensia*, which were issued under the imprint of the Herculanean Academy by Neapolitan scholars of the eighteenth and early nineteenth centuries, engaged

[1] Byron's "Don Juan," canto II.

more attention than the exploration of the ruins did, especially after King Charles exchanged the crown of Naples for that of Spain in 1759—the rock was so hard and slow to cut. Moreover, Pompeii was Herculaneum's triumphant competitor from 1748 on, when it also was discovered and identified. The Bonaparte kings of Naples, Joseph and Joachim, did much for Pompeii. Not so the Bourbon rulers, who at one time employed only "fifteen asses and fifteen children" on the ruins, when they had no royal visitor to impress. Herculaneum relapsed into a second semi-oblivion, from which it was dubiously rescued by Victor Emmanuel the Second's assignment of two thousand dollars a year to the new *scavi d'Ercolano* from his privy purse. In Campania, three thousand dollars clears about one buried dwelling house a year. But none of the lately explored buildings has rivaled the basilica of the Balbi and the great theater, or even the Villa of the Pisones. They have not located even the principal street of the old city. It is only fair to add that the mode of clearage and conservation which Fiorelli, the great reformer of the Pompeian enterprise in the seventies, introduced at Herculaneum also, is infinitely superior to the wild rummaging of the d'Elbeufs and Alcubierts. The "new ruins" are partly exposed and partly tunneled shafts.

Some day, perhaps, when curiosity ceases to lash modern explorers to dig more than they can properly digest and preserve, there will be a second resurrection and transfiguration of underground Herculaneum and of its hyperthral sister town. Of one amphitheater and three theaters already recovered, one structure, surely, could be put in condition for entertaining pageants. The house of the Roman consul could be presentably renovated with Sabatino de Angelis's excellent *fac-similes* of its own bronze statues and graceful candelabra, plus duplicates of its transported fresco paintings and mosaic floors.

The decorative significance and the artistic charm of these things was certainly far greater *in situ* than it is in the Naples Museum. And the tourist who cheerfully pays his half dollar at the gate turnstiles, is no irredeemable barbarian if he craves more Cicero and less Dante than he gets now, at the end of his melancholy pilgrimage to the Gulf cities.

Pompeii, in its weatherbeaten bareness, resembles nothing so much as the path of an unrecent conflagration. To visit Herculaneum is to visit a mine. A blotch of bright sunlight still flecks the serried seats of its Greek theater through Prince d'Elbeuf's historic hole. The bronze horses were found on that piece of masonry. These sixteen descending and concave benches were part of the cavea, for which the flower of the local population held ivory tickets on show days. Still farther down, you cross five concentric ledges of more accentuated concavity. Upon these the magistrates and the priestly colleges, the bullet-headed duumviri and portly decuriones, the sleek augustales and purse-proud knights, Roman knights, jostled their cushioned chairs, if the play chanced to be a Greek tragedy. For in that case the chorus sang and performed its evolutions in the orchestra. When the play was a comedy or a masque or a burlesque, there were orchestra chairs. But the highbrows of the period rarely got their favorite Ibsens. The play was more often a medley of music and morals, of *pas de deux* and mass alignments interspersed with sentimental dialogue, such as we too have acquired a faculty of enduring. "The Pleasures of the Enchanted Island." What think you of that? *Très* Louis Quatorze, is it not? Often, too, the people demanded an inexpensive but ridiculous farce of Harlequin and Pantaloon, learned doctor and greedy Brighella; for this is the Oscan country where that form of farce had its birth and is popular still. What flea bites have we not weathered to learn it, from Naples to Calabria!

This supposed platform, which looks like a series of holes in a tunnel floor, was the stage, so the guide says, and we marvel faithfully when he shows us how wide it

was by going to the other end of it with his shrinking torchflame. It is one third wider across than La Scala's stage at Milan is, and was backed with a niched and statued wall representing a conventional palace front, as the surveys of La Vega and the plastic model in the Resina Museum show. For little is visible of all this. The back wall was often, also, hung with painted drop scenes, and was flanked with painted side scenery mounted on triangular prisms that were easy to switch for changes. And over the open top of the house, sailors doubtless stretched great embroidered awnings to shade the spectators, as we know they did at Rome and Pompeii.

Two ivory play tickets have been found in the buried playhouses. One of them specifies seat or tier 12 in the Æschylus section. Campania evidently followed the example of Athens, where statues of the classic dramatists adorned the scene of their triumphs, and gave names to sections of the theater. One likes to think that Roman theaters encouraged many minor social pleasures besides gratifying literary taste. I doubt not that many a Herculanean lover tested the precepts of Ovid's frivolous "Art of Love" on the stone benches we are now treading. You must contrive to meet your sweetheart at the circus, says the good poet. None comes between you there. Does her cloak slip to the floor? You must dive for it. Does the dust settle on her dress? You hasten to dust it off. If none settles, you dust that. Presently she will allow you to fan her, and to dilate on the events in progress.

It is time we ceased to eavesdrop upon Ovid's Roman lovers. The uniformed guide shows us out again. It is up, up, over one hundred stone steps from orchestra pavement to the fresh night air on the streets of Portici; for it has fallen dark while we were below. It is too late now to visit the park of the royal villa La Favorita, so we drive three miles on the rattling lava pavement flags of Resina and Torre del Greco to our quarters at the Hotel du Vésuve. No time to dress. A hasty brush-down and a change of neckwear must serve. Alas for America's disgrace! They have dressed the dining room in the national colors and verdure for our special humiliation, and in honor, apparently, of Director Giuseppe Spinazzola's recent promotion to the archinspectorship of antiquities and excavations throughout southern Italy. Dr. Spinazzola, who is here from Paestum, is provokingly modest and reticent. What more has he found there? A new Greek temple, or an army of statues? "There is still better news; but you must wait for the champagne." The explorer's eyes confirm his extravagant promise with a merry twinkle.

At last the butler launches a battery of Asti spumante *grande marque* on the house, and the glad secret is betrayed. Parliament has voted one million francs for the exploration of Ercolano (applause). The King of Italy has been pleased to sign this appropriation, and to grant a further allowance of one hundred thousand dollars for the same service, from his personal resources. This credit is good for three years of operations on an imposing scale. Herculaneum will live again. It is pleasant to be reminded, by an Italian voice, that it was conceived, matured and brought to the present promise of splendid fruition by the admirable courage, skill and dogged perseverance of one American scholar, Dr. Charles Waldstein.

Night Storm Signals

A SPECIAL commission of the International Meteorological Committee, which met in London in June, 1909, proposed a set of storm signals for use throughout the world. This comprised combinations of cone-shaped symbols for use by day, and of red and white lanterns for use by night. The daytime portion of the code was accepted at the last meeting of the International Committee, held at Berlin in 1910, but has not yet been put in operation in all countries (e. g., the United States Weather Bureau [illegible] signals). The proposed [illegible]

nals, however, aroused many objections. It consisted of the following combinations of lights, in a vertical line: Two red, for a gale commencing with the wind in the northwest quadrant; two white, for a gale commencing with wind in the southwest quadrant; red above white, for a gale commencing with wind in the northeast quadrant; white above red, for a gale commencing with wind in the southeast quadrant; three lanterns, red-white-red, for a hurricane.

The meteorological service of France urged that these simple combinations would be liable to confusion with other harbor lights, and advocated a set of three-lantern combinations, in a vertical row. The German service favored a triangular arrangement of lights. Various other schemes were suggested. An enlarged commission on maritime weather signals met in London in September, 1912, and after prolonged discussion decided that it would be impracticable to secure universal agreement on a single code of night signals, but that the meteorological services of the world—with whom final decision in the matter rests—could probably be induced to agree that any combination of lamps forming a storm signal shall have the same significance in whatever country it is used. As a majority of the great maritime countries of the world were represented at the London meeting, the ultimate effect of this conclusion may probably be forecast thus: All countries will use vertical combinations of red and white lanterns to warn mariners by night of the imminence of storms and indicate the direction of the wind therein. (The proposal to display lights in a triangular arrangement has been abandoned.) Countries will have the choice of two codes. One of these will consist of combinations of two lanterns; viz., the code described above, as proposed at the meeting of 1909, except that the hurricane signal will be abandoned, and in its place a single red light will be used to indicate an atmospheric disturbance, without information as to the direction of the wind. The other will consist of combinations of three lanterns, and will include a hurricane signal. Lastly, a country may elect to use but a single lantern for night signals; viz., a red light replacing all the day signals.

A further suggestion under consideration is to use a green flag or a green lamp to indicate that no warning can be hoisted on account of telegraphic communication being interrupted, as is now done at Thorshavn, Faroe Islands.

Do Crystals Conduct Heat?

PROF. R. W. CLARK of the Mineralogical Laboratory, University of Michigan, has for several years been experimenting to determine the conductivity of heat in crystals. The apparatus used in the tests consists of a stage for supporting the crystal, so arranged that a spring presses it up against the contact point of the conducting instrument. This instrument is placed at right angles, and may be heated by a flame. The unsatisfactory results were due to the radiation of the heat. To overcome this, a plate of some mineral, such as gypsum, is dipped in paraffine until a thin even coat is formed on one side. The plate is then placed on the stage of the instrument with the waxed surface down. Strips of asbestos insulate the under edges. The point of the conducting wire rests in a depression in the upper unwaxed surface. In this way when the heat is conducted along the wire to the crystal, it must actually be transmitted through the crystal of gypsum before it can melt the paraffine. A very sharply defined ellipse will be noted in the paraffine, and this is clearly due to differences in conductivity of the crystals in different directions and not to radiations from the wire.

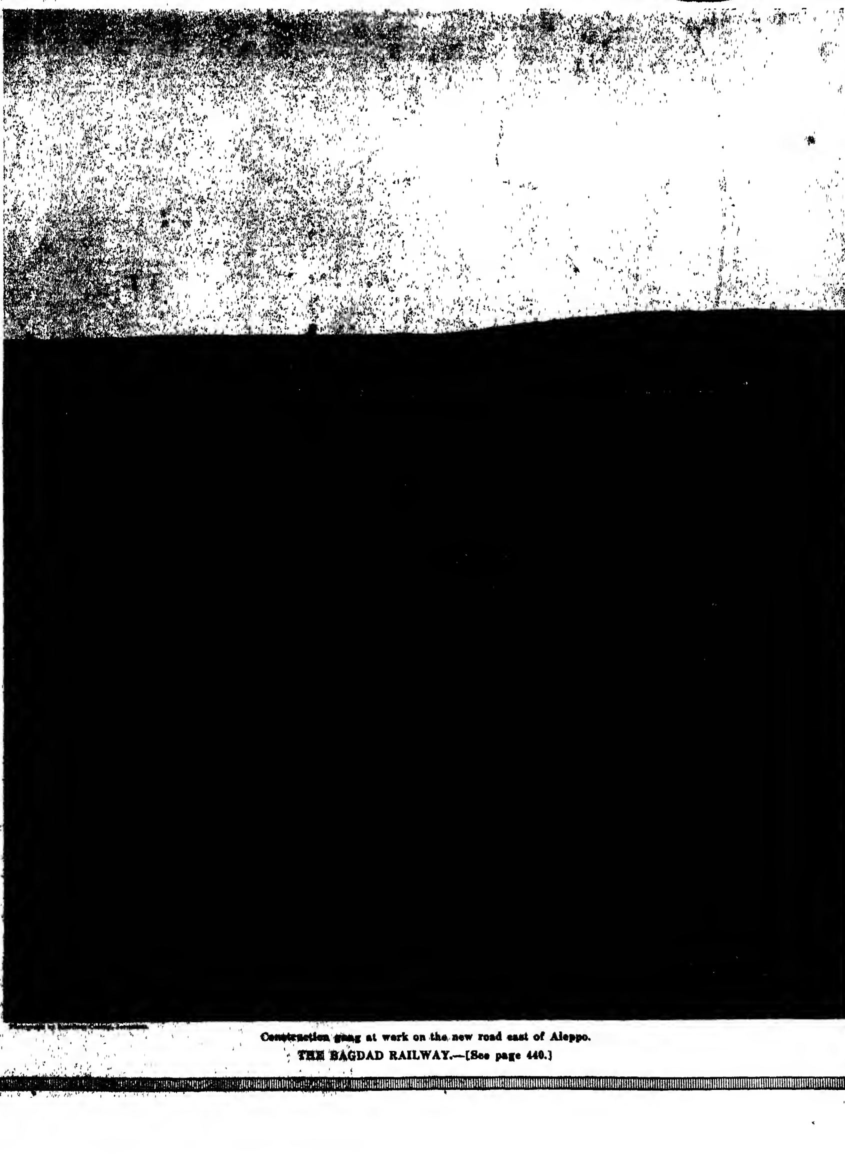
A Tree-supporting Plate.—Eugene C. Coon and Thomas R. Coon, of Portland, Ore., have patented, No. 1,040,891, a tree support which includes a U-shaped clamping plate secured to a limb of a tree with grooves to receive the tree limb and a pad in the groove to protect the limb when the clamp is applied for use.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

[illegible]] NEW YORK, NOVEMBER 23, 1912. [10 CENTS A COPY $3.00 A YEAR



Construction gang at work on the new road east of Aleppo.

THE BAGDAD RAILWAY.—[See page 440.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 23, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N.Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid,	3.75

The Scientific American Publications

Scientific American (established 1845)	per year,	$3.00
Scientific American Supplement (established 1876)	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Sherman Anti-Trust Act and the Patentee

ON April 16th, 1912, Mr. Oldfield, Chairman of the House Committee on Patents, introduced a bill, the purpose of which was to revise and amend the laws relating to patents. Twenty-six public hearings for the taking of testimony, occupying altogether fifty-two hours, were held by the Sub-Committee of the House Committee on Patents to discuss the merits and demerits of the bill. Manufacturers of patented articles from almost every city in the union, as well as prominent inventors and prominent patent attorneys testified before the committee. The discussion was limited to those clauses that provide for what have become known as the "compulsory license" and "non-enforcement of license restrictions" provisions. Out of sixty persons whose testimony or communications are reported in the hearings, only six favored these provisions. On August 8th, 1912, on the eve of adjournment of the House, the original Oldfield bill was reported back with amendments in the nature of a substitute, and with the recommendation that the substitute be passed. Congress, however, took no action upon this recommendation before adjournment. It is not unlikely, however, that when Congress reconvenes, the substitute bill will be reintroduced and an effort made to pass it. For that reason it is a matter of considerable importance to study its provisions.

The substitute Oldfield Bill provides, in phraseology, somewhat different from that of the original bill, for compulsory licenses and non-enforcement of license restrictions, essentially like the corresponding provisions of the original bill. It extends the application of compulsory licenses to an earlier date in the life of the patent, and exempts "original inventors" under certain conditions from compulsory licenses. In addition, the substitute bill contains a number of provisions extending the application of the Sherman Anti-Trust Act, wherever patents are involved, to specific transactions that are not now covered by the Sherman Anti-Trust Act, and which, if no patents were involved would, under the existing law, or even under the substitute Oldfield Bill (if passed) lie outside the prohibition of the Sherman Anti-Trust Act. This extension of the Sherman Anti-Trust Act, by which specific transactions, now lawful, would become *ipso facto* violations of the Sherman Anti-Trust Act in case they involved patents, but would remain lawful in case they did not involve patents, was not present in the original bill. It was not discussed or suggested by anyone upon the hearings and was not foreshadowed by any patent legislation previously proposed in either branch of Congress.

The scheme for the extension of the Sherman Anti-Trust Act resembles that of the proposed amendments to the Sherman Anti-Trust Act introduced earlier in the session by Senator La Follette and Representative Lenroot, except that their proposed amendments to the Sherman Anti-Trust Act avowedly applied to all articles of commerce, patented as well as unpatented. The Oldfield substitute bill, however, by excluding from its provisions all the transactions involving unpatented articles and limiting its application exclusively to patented articles, discriminates drastically against patented articles and grossly in favor of unpatented articles.

Thus, when the vendor of any patented article attempts to restrict the price at which that article may be sold, he violates the Oldfield extension of the Sherman Anti-Trust Act. So, too, if he attempts to restrain a customer from buying or using an article obtained from somebody else, whether such attempts be made by agreement against the purchase, or by a condition of sale against the purchase, or by a restriction upon the use of the patented article sold, or by making in the price of the patented article any discrimination based upon whether the customer buys the article from somebody else, the Oldfield Bill is violated. If the vendor of any patented article, with a view to preventing competition with that article, acquires any other patent or license, he again infringes the proposed law. When the vendor of any patented article, with a view to restraining competition, makes in the price of the patented article any discrimination (other than the ordinary wholesale discount) based upon whether the customer buys from him goods of a particular quantity or aggregate price, he is to be punished as the Oldfield law prescribes. He is forbidden from attempting to restrain competition, either by refusing to supply somebody or by consenting to supply anybody only upon terms or conditions less favorable than are accorded to anybody else. He may not attempt to restrain competition by supplying to somebody in any particular territory patented articles upon terms or conditions more favorable than are accorded to other customers. Nor may he attempt to restrain competition by making any arrangement under which he shall not sell his patented article to certain classes of persons or to those doing business in certain territories.

No one who deals in any patented article may do business under any name other than his own or that of his firm or corporation; no one may "misrepresent" the ownership or control of his business, or of the identity of the producer or vendor of any patented article sold. The vendor of any patented article must not attempt to prevent competition, by supplying the article at a price at or below the cost of production and distribution. He must not secure information concerning his competitors' business through bribery of an employee of his competitor or of any Government official or by any illegal means. He may not fix an unreasonably high price upon some material not subject to a patent, which he controls and which is required for producing a competitive article. He must not attempt to restrain competition by use of any unfair or oppressive means of competition.

Whenever a combination, in violation of the Sherman Anti-Trust Act, is shown to control any patented article, "reasonably required" in manufacture, production, general consumption or use, and "no adequate opportunity exists to immediately substitute another article therefor of real utility" the court shall compel the patent owners to supply the patented article until some other adequate substitute can be provided, upon payment of either "a reasonable compensation to be fixed by the court" or an amount of compensation payable according to any valid contracts then existing. Final judgment in a civil proceeding that a defendant has violated the Sherman Anti-Trust Act by the use of any patent in any manner prohibited by the act shall constitute, as against that defendant, conclusive evidence of the facts and as to the same issues of law in favor of any other party in any other proceeding involving the Sherman Anti-Trust Act. Whenever a defendant has been adjudged in a civil proceeding to have violated the Sherman Anti-Trust Act, by the use of any patent in any manner prohibited by the act, anybody claiming to have been injured by his conduct may intervene within three years thereafter, and be admitted as a party to the suit, and shall have judgment for the damages resulting from such injuries in exactly the same manner and extent as if he had begun an independent suit to recover damages. When a combination has used any patent in any manner prohibited by the Act and has been adjudged to have violated the Sherman Anti-Trust Act, the court may partition its severalty among groups of stockholders or sell it in parcels as a whole and forbid former stockholders to buy at the sales. Whenever it appears in a civil suit by the Federal Government under the Sherman Anti-Trust Act that a patent has been used in any manner prohibited by the Oldfield Bill, any person or estate threatened with injury may at any time intervene as a party. Whenever it is alleged in an action by the Federal Government under the Sherman Anti-Trust Act that a patent has been used in a prohibited manner, no department or official of the United States shall contract to buy anything from the defendant or its subsidiaries until the allegation "be found on final decree to be unfounded" unless no substitute of equal utility and at a [illegible] price [illegible].

What becomes of the [illegible] granted to the inventor by the Constitution of the United States? What is the good of a patent if [illegible] is to become a law? What inducement [illegible] inventor to spend years, and possibly [illegible] lars in perfecting an invention that only makes [illegible] cheaper, transatlantic travel safer, or aeroplanes automatically stable? Why not abolish the patent laws entirely and thus prevent the inventor or his assignee from enjoying the fruits of his ingenuity and labor in the manner contemplated by the Constitution? That would at least be legal and constitutional, which the substitute Oldfield Bill is not. But it would also be just as ridiculous.

Longer Ships—Longer Piers

THE application of the German steamship companies for permission temporarily to extend their piers at Hoboken in order to accommodate their larger steamships, and notably the "Imperator," which is due here in May of next year, has been rejected by Secretary of War Stimson. The action of the Secretary is an indorsement of the opinion of the army engineers, who believe that any further extension of the piers, even of a temporary character, into the fairway of the North River would be detrimental to the interests of the port of New York. To the army engineers is intrusted the guardianship of the rivers and harbors of the country, and it is their duty to see that no encroachment is made by private or corporate interests on the anchorages, channels, or fairways of the country by such interests at the expense of shipping in general. Although the channel at New York between the Manhattan and Jersey shores has a clear width between pierhead lines of about half a mile, the army engineers believe that this is none too much to accommodate the present traffic, to say nothing of its probable large increase in the future.

If the War Department is to have its way in this matter—which is not by any means certain—the question of making provision for these big ships becomes very pressing. It is futile to protest against their ever-increasing dimensions; for their growth is due to a fixed economic law, well understood in the field of transportation; and that the sun will rise to-morrow is scarcely more sure than that the one-thousand-foot ship, within a few years, will be afloat upon the high seas. Furthermore, their port of call in the western hemisphere will be somewhere on the Atlantic seaboard of the United States, and it can be safely predicted that the port will be New York. Where, then, shall these huge vessels be accommodated? Boston and New London are out of the question; and the terminus at Montauk must ever, for economic reasons, remain a mere dream. Passengers will never consent to a change from the spacious comfort of an ocean liner to the comparatively cramped quarters of a Pullman car, merely for the sake of taking a two-hour ride through Long Island into New York. They will always ask to be carried to the city itself and as near to its heart as is possible. For this reason the proposal to berth the steamships at South Brooklyn will be always unpopular. It begins to look as though a new steamship center would have to be formed further up the Hudson River, and piers of 1,000 feet length or over constructed by excavating, if indeed this should prove to be necessary, at their shoreward end, in order to secure the desired length.

The SCIENTIFIC AMERICAN, however, is still of the opinion that the requested extension of the piers should be granted, and this for the reason that the width of the channel at New York is far greater than that of any other of the leading ports of the world. If the War Department should allow an extension on each side of the river sufficient to accommodate ships one thousand feet in length and then establish a pierhead line which should be irrevocable, there would still remain a fairway several hundred feet wider than that of any other seaport of the first rank.

Notice

IN view of many inquiries received from subscribers and advertisers relative to a new edition of the Encyclopedia Americana and certain other publications issued or sold by the Americana Company or "Scientific American Compiling Department," Messrs. Munn & Co., Incorporated, state that such publications have no connection whatever with the SCIENTIFIC AMERICAN published by them, and that Messrs. Munn & Co., Incorporated, have no interest of any sort in the business of the Americana Company or of the so-called "Scientific American Compiling Department." The use of the words "Scientific American" in connection with the latter is without the approval or consent of Messrs. Munn & Co., Incorporated, and notice has been served upon the Americana Company that the use of the above title must be discontinued.

Science

An Astrophysical Observatory is to be built at Victoria, British Columbia. The Dominion government has appropriated [illegible] for this purpose.

Mountain Weather Station in Argentina.—The Argentine government has established a meteorological station on [illegible], Province of Cordoba, at an altitude of [illegible] feet.

A New German University is to be established at Frankfort on the Main. A number of existing educational and scientific institutions, including the local medical schools and the Physikalischer Verein, will be absorbed by the university, which will be further built up by various donations and foundations. About $1,730,000 is already available.

How to Bleach Ivory.—To bleach ivory ornaments or piano keys the following method works well. The ornaments are first washed or "soaked" if possible in a bath of unslaked lime, which has in it a few ounces of bran and water. This should make a pasty solution if properly mixed, and will bleach the ivory which is discolored or stained. It should be rubbed off with a cloth and the ivory dried in magnesia powder. After a few minutes a few strokes with a cloth gives the ivory a brilliant polish.

Dr. Flexner Delivers the Huxley Lecture.—The annual Huxley Lecture to the Faculty and students of Charing Cross Hospital was delivered this year by Prof. Simon Flexner of the Rockefeller Institute of New York. The subject was "Some Problems in Infection and Its Control." Not for many years has so great an interest been taken in the Huxley Lecture. Long before the hour fixed for the proceedings to begin in the theater of the hospital, every available inch of space had been taken by as distinguished a medical audience as ever attended this important event.

New Instrument for Analyzing Gases.—By the use of a new German instrument, which takes the index of refraction of mixed gases, Haber and Löwe are able to find the amount of carbon dioxide and methane contained in mine gases. The method is also useful in many other cases such as for benzol vapors in the gas distilled by gas or coke plants, also sulphurous anhydride in the gases coming from pyrites roasting, as well as percentages of ozone in the air. They are also able to check the purity of hydrogen made by the electrolytic process, observe the gases in human breath and carry out other very useful tests. Recently O. Mohr applied the method to analyzing the products of combustion of furnaces so as to have a useful check upon the way the fuel is being burned.

Borrelly's Comet.—A telegram received at Harvard from Prof. A. O. Leuschner, of Berkeley, Cal., gives the following elements and ephemeris of Borrelly's Comet, computed by Nicholson and Lansendorf from observations on November 3, 4 and 5:

ELEMENTS.

Time of perihelion passage	(T)	1912, Oct. 20.53 G.M.T.
Perihelion minus node	(ω)	98° 52′
Longitude of node	(☊)	143° 18′
Inclination	(i)	124° 52′
Perihelion distance	(q)	1.105

EPHEMERIS.

G.M.T.			R.A. h.	m.	s.	Dec. °	′	Light.
1912	November	8.5	18	32	13	+28	51	0.88
		12.5	18	53	56	+22	54	
		16.5	19	11	36	+17	38	
		20.5	19	26	18	+13	04	0.51

Amundsen's North Polar Expedition is now assured, thanks to the liberality of Pedro Christofferson, a rich Norwegian living at Buenos Aires, whose financial aid also made possible the journey which resulted in the discovery of the South Pole. The explorer returned to his home in Norway the 1st of August, where he has been putting the last touches to the report of his recent journey, delivering lectures, and hastening preparations for his forthcoming drift across the north polar basin. His ship, the "Fram," which he left at Buenos Aires, was expected to sail in October for San Francisco, to complete fitting out, and the start from that port for Bering Sea is planned for June, 1913. Amundsen will push as far north as possible before engaging his vessel in the ice, with which she is expected to drift still farther north, and thus pass closer to the pole than did De Long, with the "Jeannette," or Nansen, with the "Fram." However, no special effort will be made to reach the pole. The object of the expedition is to make a thorough exploration of the polar sea, including its currents, depths, the character of the bottom, and the meteorological conditions. The explorer hopes to drift from north of Bering Strait to the eastward of Greenland in three years, but the expedition will be provisioned for at least five years. It is just possible that the Norwegian party will encounter the American Crocker Land expedition which is to proceed westward over the ice from Grant Land next year, and that one or both of these parties will fully explore the land which Peary saw far to the westward during his march to the pole.

Aeronautics

Appeal for Military Aviation in England.—Owing to the success which the public subscriptions are having in France for the purchase of aeroplanes for the army and the poor results coming from a like subscription opened in England for two months past, Major Gen. Arbuthnot, who is president of the British Aerial League, has addressed a new appeal to patriotic sentiment in favor of military aviation in England.

From London to India.—The well-known English aviator Cody is making plans to take part in the flight from London to India. This event has lately been organized and is likely to be of great interest on account of the unusual length of the trip. Several important prizes are to be awarded for the flights. However, the organizers are likely to postpone the event for some time, owing to the fact that the original path lay across the Balkans.

Monument to Latham.—After Blériot, who has a monument erected near Calais to commemorate his cross-Channel flight, Hubert Latham is now to have a monument as well. This will be located on the heights of the Sangatte cliffs at the point where he started on his flight. A group of sportsmen are organizing a subscription for this purpose, so as to commemorate the two attempts to cross the Channel, in one of which he practically succeeded, as it will be remembered that he came very near landing on the English coast. Latham was the first aviator to have the idea of crossing the Channel, which was considered a very bold attempt at the time. We may also mention that a committee has been organized to erect a monument to aviation pioneers, and especially to Wilbur Wright, at the Auvours camp.

Stabilizing Parachutes for Aeroplanes.—Trials of a new stabilizing parachute for aeroplanes were made recently at the Eiffel Tower by the inventor, Triaire. On this occasion the apparatus was a reduced model of one-quarter size and had been ballasted with lead, the total weight being 160 pounds. The aeroplane is of the monoplane type, and provided with the new device it was raised by cable to the first platform of the tower. After being placed in the most unfavorable position as regards capsizing, the aeroplane was dropped, but it was able to right itself after a rapid fall of some 30 feet, and then landed on the ground without any damage. It was noticed that when the aeroplane, which had about a 10-foot spread, was let fall, a strong wind overturned it on one side, but the stabilizer acted at once to restore the machine, and it alighted slowly at the base of the tower. This is the second trial which the inventor has now made with his device, and its success appears to be so clearly shown that he proposes to apply an apparatus upon a full-sized aeroplane and will pilot it himself in order to give a convincing demonstration.

Aviation in French West Africa is discussed in *La Technique Aéronautique* by a superior officer of the French colonial infantry. Many pessimistic statements have been published regarding the difficulties of aviation in the Sahara and adjacent tropical countries—warping of wooden frames, clogging of the motors with sand, rapid evaporation of gasoline, difficult country for landing, and what-not. Hence it is highly gratifying to learn from an authoritative source that all of these statements are erroneous, and that actual experience has proved aviation to be, on the whole, neither more difficult nor more dangerous in the heart of Africa than in the heart of France. Military aviators have made many long flights in the region in question; one of them covering about 350 miles. In Senegal it is found that the sand borne by the winds does not extend more than two or three hundred yards above the ground. It is evident that the new arm of the military service will greatly facilitate the administration of these colonial possessions. The nomadic natives still indulge in frequent raids, which will probably be entirely suppressed by the combined efforts of the aviators and the *méharistes* (troopers mounted on swift camels).

Hydro-aeroplanes in Europe.—Experiments with new hydro-aeroplanes are being actively carried on in different parts of Europe at present, and we may mention the tests which Beaumont made upon the Seine near Paris with a Donnet-Leveque 50 horse-power machine, taking on board Mr. Lowe, an engineer representing the English Vickers establishment. Then the machine was taken apart and shipped to England, where Beaumont is to put it through the official tests required by the Admiralty. On the same day, Kuhling made flights with a 50 horse-power Donnet-Leveque machine, while Mr. Lowe piloted a third machine, also of 50 horse-power. In the Mediterranean, the Italian training school at Golfe Juan is a leading center. Lieuts. Gavazzi and Roberti are making flights of long duration and show great skill in alighting on the water, flying around the battleship "Condorcet" which is anchored in the bay, and making evolutions above Cannes. Chief pilot Mollieu is trying out a machine which is ordered for Italy. In Switzerland, Burri, mounted on a Sommer hydro-aeroplane, closed the events on Lake Leman by a flight over the lake from Geneva to Evian, accompanied by Com. Dolfus.

Automobile

A Wind Shield for Motor Cycle.—The patent, No. 1,042,305, to Chauncey M. Wright of Philadelphia, presents a wind shield in which the shield member is clamped to the handle bars of a vehicle and springs are arranged between the portions of the shield member and the clamps, thus cushioning the connection with the vehicle.

How to Clean Spark Plugs.—A good way to clean spark plugs or any mica substance is to first wash in a 10 per cent solution of acetic acid, which cuts grease and carbon deposits. This should be washed off by gasoline and then the plug dried by rubbing with a cloth or waste shreds. This works exceptionally well on all mica substances, but is good for removing carbon deposits from other articles.

Driving Out the Horse-car in Wurtemburg.—The government of Wurtemburg, Germany, is taking steps to substitute autobus lines for all the horse traction lines existing in the country, and it is now engaged in drawing up the plans for the project. The department has already entered into connection with the leading German automobile constructors in order to secure their co-operation in the enterprise, and bids will no doubt be called for in the near future. At present the department has not made any definite decision in the matter.

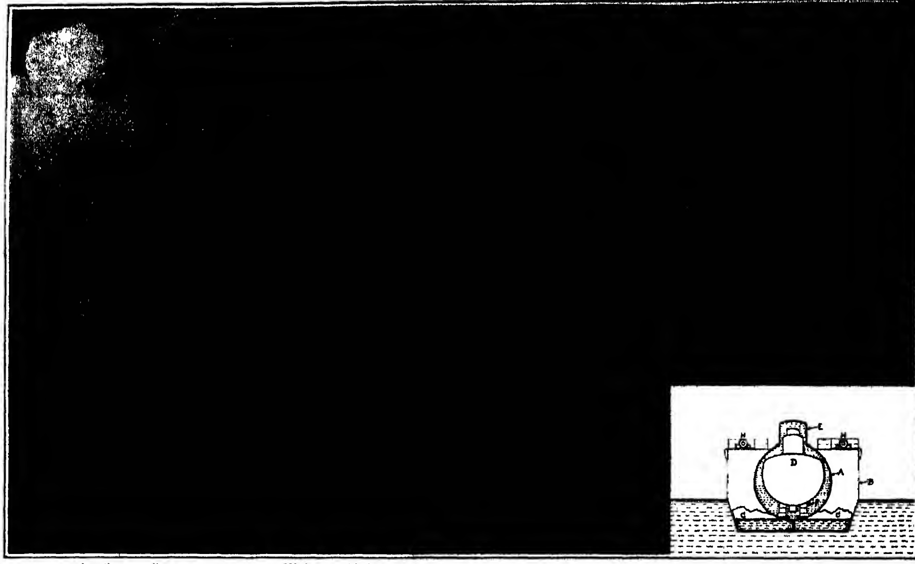
Car for Transporting Automobiles.—The Orleans Railroad Company of France is now using a well-designed car for carrying automobiles where the latter are packed in closed boxes. The new car is about 22 feet long and 8 feet in width with a somewhat greater height, and owing to the roomy space which it affords it is able to carry the largest automobiles. These are loaded into the end of the car, which is fitted with two folding doors and a flap which is let down so as to make a platform flush with the car floor. Side doors in the car also give access for carrying out operations. A set of cleats on the floor and also solid straps at the sides, allow of fixing the automobile body in the best manner to avoid all shifting on the road.

A Hospital on Wheels.—The new French Schneider ambulance is a veritable portable hospital, being a truck of probably the largest size yet constructed and having an operating room in the middle part, with two smaller rooms at the ends. It contains an electric plant which is used for lighting, water pumping and sterilizing and for surgical motors. Water is pumped in by hose from a well or pond, and after passing through the ultra-violet ray sterilizer it is stored in a tank. When the ambulance is brought to the spot, for instance on a battlefield, a wing in the shape of a tent is formed by a tarpaulin on each side of the wagon, and the two tents are electrically lighted through windows in the sides of the car.

A Refrigerator Motor-truck.—A 35 horse-power truck of the De Dion type is in use at Buenos Aires for transporting meat, and it is designed as a refrigerator car on the most approved principles. The present car has a body of unusually large size and height and weighs 5 tons. In the same connection we may mention a De Dion car for ice delivery which is now in circulation at Havana. It has a 24 horse-power motor and the total weight is 3.3 tons. The same establishment is building a number of cars of automobile-ambulance type for transporting the wounded. These are comparatively light and rapid. One of them is in use by the city of Mullhausen (Alsace) and a second has been supplied to the relief committee of Havre.

Transport for Race Horses.—Among the new French power wagons built for special uses we note the truck which was delivered to Mr. Gould at Paris and serves for transporting race horses. It is a roomy van with the driver's seat in front and carries a 30 horse-power motor. Built according to the Latil system, the front truck is motor driven and forms a unit with the motor and mechanism, leaving the rear axle free. A handsome car of about the same design was also built for Mr. Vanderbilt. Another Latil car is mounted as a street sprinkler and sweeper and is used by the municipal department of Paris. A large truck of the same type is built for transporting aeroplanes. The van can be tilted down to the ground level in the rear so as to unload the aeroplane by sliding it down ways.

Four-wheel Drive.—The new Panhard power wagon has an original feature in that all four wheels are driven as well as steered, all the wheels being operated by a single differential. At Satory, near Versailles, a tractor of this kind was driven up a bank 14 inches high and over a log 16 inches in diameter. Using the first speed or 2 miles an hour, it could run up a bad piece of chalky road containing ruts and having a 28 per cent grade. The maximum speed was 10 miles an hour. With a trailer weighing 6.5 tons it could mount a 9 per cent grade using the first speed (accelerated), and with the second speed, or 4.5 miles an hour, it climbed a 4 per cent slope. The same slopes could be climbed in first and second speeds with a pair of 5-ton tractors serving as trailer load and representing a total of 10 tons drawn by the power wagon. The truck has a 6-cylinder 35 horse-power motor. A drum on the car allows of cable hauling at a speed of 1.2 miles an hour and a pull of 4 tons.



Length over all	235 feet	Displacement light	500 tons
Length available inside	213 feet	Displacement loaded	925 tons
Internal diameter of pressure tube	23 feet		

A, pressure tube; *B*, caissons; *C*, water ballast; *D*, submarine; *E*, pressure hood for conning tower; *F*, keel blocks; *H*, electric winches.

Italian salvage vessel and testing dock for submarines.

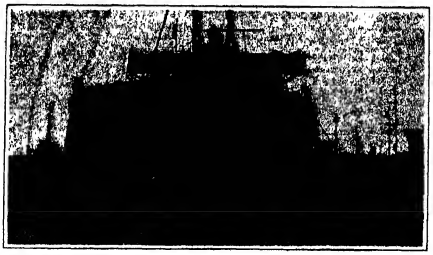
Salvage and Testing Facilities for Submarines

By R. G. Skerrett

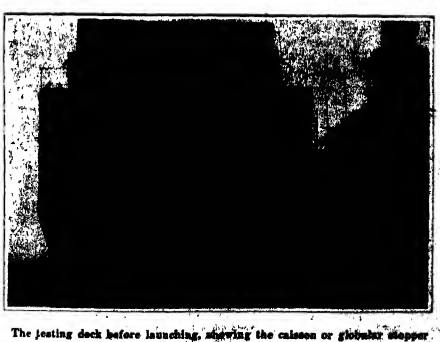
THE difficulties encountered in raising the sunken British submarine "A3" have in them a note of warning for us. We are steadily adding to our flotilla of under-water craft, and yet we have no proper facilities in the Government service for the prompt salvage of any of these boats should they be carried suddenly to the bottom. We have been fortunate so far in escaping serious accidents, but that is no reason for assuming that we are any more likely to be immune from disaster than any other naval service. We should profit by the catastrophes which have befallen England, Russia, France, Germany, and Japan, and no longer continue unprepared for kindred mishaps.

Public opinion, revolting at the inaction of the Ministry of Marine and reaching a climax of indignation at the delay in raising the unfortunate "Pluviose," forced the French authorities to undertake the construction of a salvage vessel especially adapted to deal with sunken submarines. The accompanying illustration shows the boat provided by the French government late last year. The Germans anticipated the French in this particular, and their special salvage craft, the "Vulkan," proved useful when the "U3" sank in the Baltic more than a year ago. England is slowly equipping herself with the same character of vessel, but the difficulties that have attended the raising of her several submarines that have gone to the bottom have shown the insufficiency of the apparatus at present at her disposal.

It is not pleasant to think that men may be carried to the bottom in under-water boats under circumstances which make it possible for them to survive in their confinement for many long hours and yet, in the end, die because the salvage equipment is inadequate to cope with their relatively speedy raising. This has happened abroad, upon several occasions, under harrowing conditions, and it may occur here if some provision is not promptly made to prepare for just such an emergency. It is not fair to the men that take the risks necessarily involved in service aboard submarines to hesitate longer in building the required salvage apparatus.



The German salvage vessel "Vulkan." Can lift 500 tons 25 meters in an hour.



The testing dock before launching, showing the caisson or globular stopper in place.

There are some kind of accidents which may send a submarine to her doom and against which no foresight can provide; but, again, there are other circumstances which may cause a submarine to sink and which may be either entirely eliminated or largely minimized by prevision. To a large extent, this anticipation of accident lies in making the submarine strong enough to resist the stresses of deep submergence and in equipping the boat with pumps and other tried means for the expulsion of water ballast or for the neutralizing of reasonable leaks at those depths. It will be asserted authoritatively that we are now taking these very steps, and it is a matter of common knowledge that our submarines, before their final acceptance by the Government, are actually subjected to a submergence test which requires the boats to be sunk, without anyone aboard, to a depth of 200 feet. The inspiration for these trials was an accident to one of our own submarines of the first group built, which, when 125 feet down—she was carried there by leaky valves—leaked so menacingly that she was brought by her crew to the surface again only through the desperate working of a single hand-pump. It was a very close shave for her people, but it taught the Government a salutary lesson.

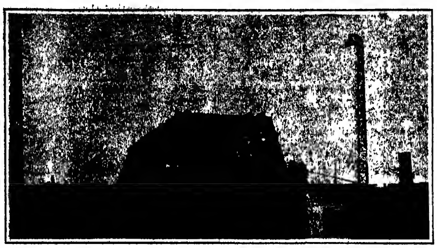
But there are circumstances incident to the present method of subjecting the hulls of our submarines to test which are far from ideal, and they do not give a true index of all the conditions which bear importantly not only upon the future safety of the submarine in service, but

[illegible] the chief in guiding the designer [illegible] improvement. Our inspectors examine the submarine after she returns to [the] surface, and they have imperfect [means] of telling just what has been going [on] within the craft at each stage of her submergence and her ascent. The instruments employed do record the amount of [bu]lding or deformation of the hull at the particular points where these registering apparatus are placed, but there is much besides this data which is well worth the knowing, and which cannot be ascertained in this way. It would be valuable to know if the pumps in the boat would work efficiently against the head of water 200 feet below the surface; it would also be of importance to learn whether or not the air system could expel water ballast at that depth, and, if so, whether the tank walls would be able to stand up against the contending strains; and, likewise, whether all of the sea connections and associate valves could be relied upon under such conditions. This data is virtually a matter of assumption as the tests are now conducted. Apart from this, it is not always convenient to take a submarine to an off-shore position where a depth of 200 feet of water can be assured; and the present facilities for sinking her and raising her are fairly crude, and can be put into service only when weather conditions are favorable.

The special salvage vessels already built in Germany and France and under construction in England can help in carrying out test submergences of submarines, and do, in fact, provide more flexible facilities for this operation than the ordinary wrecking derrick and lighter which we utilize, but it is still necessary that the submarine be carried to deep water for the purpose, and deep water is not always conveniently available. Perhaps the inspectors would be more willing to go down in the submarine undergoing test if the boat were attached to one of these special salvage craft, but this is a matter of speculation. At present, we have no salvage vessel of this sort, and, even if we had, it would not be the best solution of the problem as it has developed with the growth and the wider service now exacted of under-water torpedo boats. It is to Italy that we must turn for the most startling development of a submarine auxiliary, a structure which combines the virtues of a special salvage craft with a testing dock of a novel and extremely valuable character.

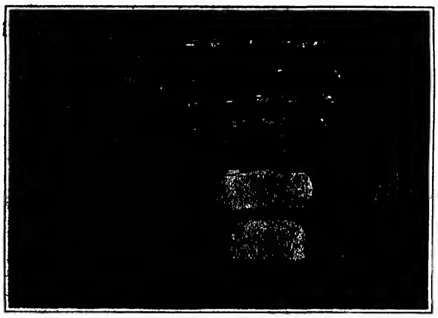
There has recently been launched at Spezia, Italy, for the Italian navy, a craft of this dual character, which is far ahead of any other equipment yet provided by the various maritime powers having flotillas of submarine boats. The Laurenti testing dock, designed by Major Cesare Laurenti, technical director of the Fiat-San Giorgio, puts the submergence trials of a submarine upon a thoroughly safe and practical line of procedure, and, at the same time, makes it possible to obtain at first hand data of the utmost importance not only regarding the physical possibilities of the particular submarine undergoing examination, but also information which will point surely to the way to make improvements.

We must not forget that the dual service required of a submarine on the surface and under water demands a form of hull which must, of necessity, be a compromise. The spindle shape is best for submerged speed, while the ship form lends itself better to surface conditions and rapid propulsion on the water. The circular cross-section of the spindle is the simplest and the least expensive unit of strength, while the elliptical or ship-shaped section is naturally weaker and harder and more costly to build for any unit of great strength submerged. Each change of form, therefore, demanded by military requirements introduces a new factor of uncertainty, and the real strength of any cross-section can be determined best by actual construction and a pressure test. The Laurenti dock makes it possible to get this information at a modest outlay and to try experimental sections without the building of an entire submarine. This is an advantage of incalculable value, and the beauty of the scheme is that the work can be done at the shipyard and in shallow water.



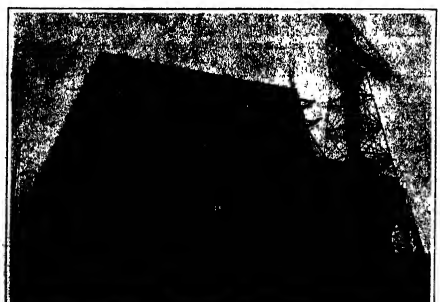
Bow view of French salvage vessel for submarines.

The testing dock in a drydock with the workmen engaged in withdrawing the caisson.



French salvage vessel.

Displacement, 2,800 tons; length, 322 feet. Can lift 1,000 tons from a depth of 120 feet



Stern of French salvage vessel, showing catamaran arrangement of the two hulls.

Free space between hulls, 41 feet 6 inches.

The Laurenti equipment consists fundamentally of a long steel tube *A*, capable of withstanding high pressures exerted from within, into which a submarine *D* can be floated and secured, after which the entrance is hermetically sealed. In our picture, the gateway is shown on the left sealed by the convex caisson. The pressure tube is supported by ballast tanks *B*, which can be filled with water ballast *C* or exhausted as occasion requires. The dock has its own power plant and its own pumping equipment. A removable hood *E* provides a housing for the conning tower. The tube is supplied with keel blocks *F*, and electrically-driven capstans *H H*. When the submarine is held within the dock and surrounded by water filling the tube, as shown by the small diagram, pressure is exerted upon the enveloping water by a suitable steam pump, and this pressure can be raised greatly in excess of the hydrostatic pressure to which a submarine would be likely to be subjected voluntarily. Observers remain in the submarine while undergoing this pressure trial, and telephonic facilities keep them in touch with those in charge of the dock and the pumping plant. In this way, the inspection can be carried on deliberately and exhaustively, and all of the operative mechanisms can be put in motion and tried under physical conditions truly reproducing the circumstances of actual deep submergence. There is no hazard involved, and the whole operation can be conducted right at the building yard.

Our illustration also shows how the Laurenti dock can be used as a salvage apparatus. In this manner a sunken submarine can be raised and carried into port or borne to shallow water, where she can be opened and entered if such an operation be desirable. In addition to being a testing dock, the Laurenti submarine auxiliary can also be employed as an ordinary floating dock for under-water boats, and in our picture the plating is removed amidships to show a submarine resting inside upon the keel blocks.

Nothing else designed up to date can be compared with Major Laurenti's invention, either in its practical advantages in meeting the varied possible requirements of submarines already built or in providing a guide for future development. The dock in question is long enough to accommodate a submarine of 200 feet in length and has a displacement of 500 metric tons when light. The dock's maximum displacement is 925 tons, at which time, with a large submarine inside, the structure draws only 10 feet of water.

Progress of a South American City

PROBABLY there are educated people in the United States of North America who have never heard of Sao Paulo. This Brazilian town, the capital of the great coffee-growing State of the same name, now has an estimated population of 380,000; and it is anticipated that within 15 years it will reach the million mark. Although 4,000 new houses were erected in the city during the past year, the demand for houses greatly exceeds the supply, owing to the rapid increase of population, and rents are exorbitant. A magnificent opera house, constructed by the municipality, was opened last year with a brilliant season of Italian opera. The old cathedral is to be torn down to give place to a new one, which will cost $2,000,000, and will be one of the notable churches of the world. Finally, a vast scheme of city improvements has been inaugurated, under the advice of M. Bonvard, architect for the city of Paris. It will include splendid boulevards and viaducts, asphalted streets, and a public garden, at an estimated total cost of $20,000,000, toward which the State government has already appropriated $3,500,000.

Flying-Boat Races

By Glenn H. Curtiss

IT is not difficult to understand why a sheet of water affords an ideal aerodrome. In the first place, the aviator does not have to run along a given course to start, and he can always head into the wind. Then again in landing, he does not have to be so particular, because the surface of the water is sure to be level, whereas from an altitude a field which looks level may turn out to be quite impracticable as a landing place. Another advantage of water flying is that the wind is much steadier over the water. Altogether, it is much easier and safer to start and alight on the water than on the ordinary flying ground. In addition to this, if as a result of careless landing and the inexperience of the operator an accident does happen, it is not likely to be serious.

The hydro-aeroplanes gave us all these advantages in water flying, but the new "flying boat" gives us in addition the advantages to be found in a boat with its large surplus of buoyancy, seaworthiness and protection for the aviators. The new Curtiss "flying boat" will ride as rough a sea, either under power or adrift, as any motor boat of its size and flies as well as any aeroplane of equal proportions, so that the combination gives us the advantages of the motor boat and the aeroplane combined, and there are no limitations to the development of this type of machine.

The many fatal accidents to exhibition fliers using land machines has directed the attention of all interested in aviation to the flying boat. This machine offers a means by which aviation may be enjoyed as a sport and developed and advanced as a science without the dangers which heretofore accompanied flight.

The flying boat shown in the illustration has a hull 25 feet long by 2½ feet beam, carries 250 square feet of plane surface and an 80 horse-power water-cooled motor with a propeller attached direct to the engine shaft. It has a carrying capacity of 600 pounds and will carry fuel supply for a flight of 400 miles. It is fitted with dual control so that either the operator or passenger who sit side by side may assume full control of the machine.

In starting from a standstill in the water, the machine, after attaining a speed of about ten miles an hour, rises to the surface on which it travels as a hydroplane until it reaches a speed of 45 miles an hour relative to the wind, when it will leave the water at a slight inclination of the elevator. It maneuvers quite readily on the water at all speeds, and will turn circles of a short radius either at high or low speed. The boat is built very strongly, as it must necessarily be, to withstand the shocks of starting and alighting in rough water.

The accompanying illustrations show two of the new flying boats and a hydro-aeroplane in the first race of the kind ever held. The race was arranged for the students and visitors at the Curtiss Aviation School at Hammondsport on the afternoon of October 28th. All who witnessed the race are unanimous in the opinion that yachting with the flying boat is destined to be one of the greatest of sports.

The sight of three machines jockeying for position was inspiring, while the close finish of the return trip would stir the blood of any sportsman. The three machines were all fitted with the same engine power, but the flying boats proved speedier in the air and faster in making turns on the water, a rule of the contest being that the machines must round the buoy on the water and must fly only between the starting and finishing points excepting on the third lap, which was the finish.

Two flying boats and one standard hydro-aeroplane jockeying for position at the start of race.

Forty-five miles an hour on the water.

Finish of race. David McCullock in his flying boat leads; Lincoln Beachy is second; Francis Wildman is third.

Some Developments in Wireless—I

By John Hays Hammond, Jr.

SINCE the first conquests of space by Hertzian waves, what has been the main development in the perfection of wireless communications? It may be stated that the chief inventive energy has been concentrated on the practical problem of increasing the effective range of intercommunication and the selectivity of the individual system. In 1897 Mr. Marconi transmitted messages to a distance of 8.7 miles. To-day Mr. Marconi says that the maximum effective distance of transmission is 6,000 miles. It is evident from a consideration of these figures that not merely a quantitative change has been made in the system of transmitting energy, but that vastly improved means of effectively utilizing this energy has been made.

In this connection it is interesting to note that Count von Arco estimates that whereas a few years ago only 50 per cent of the available energy at a station was used in radiant energy to-day, by quenching the oscillations in the primary circuit, 75 per cent of the energy is converted into useful work. This remarkable advance in power economy has been brought about chiefly through the better understanding of the conditions that would allow of more sustained electrical oscillations in the open circuits of the transmitter. The receiving stations, on the other hand, have been rendered infinitely more sensitive to the reception of weak signals by discarding the coherer principle of wave detection. The coherer, whose principle is generally understood, was discovered as early as 1879 by Prof. Hughes, and rediscovered in 1890 by Branly. This instrument was used for several years in commercial practice, but was discarded some years ago for numerous more sensitive detectors. To-day the telephone is used in conjunction with suitable detectors, and has been found to be astonishingly sensitive to small currents. Besides modifications in the apparatus to insure the greater sustainment of electrical oscillations, an important discovery of Lord Rayleigh was recognized as an essential factor in designing a wireless system. This discovery is the physiological law that the human ear allows us to hear best, sounds of between five hundred and one thousand vibrations a second. Accordingly, alternators were built of 500 cycles, a thousand electrical impulses per second were produced at the sending station, and the receiving operator heard a high musical note. In this way not only may we consider that the receiving instruments have been rendered more sensitive, but the human ear itself has been made to respond better to incoming signals.

The Problem of Selectivity.

Another important pursuit in wireless has been the development of means to secure a selective intercommunication between the sending and receiving stations. A certain amount of selectivity has been obtained on the principles of electrical tuning. Many of the requisites in economical long distance transmission resemble the requirements for accurate tuning, and in this way the theoretical development of wireless is well advanced. The chief source of trouble lies in the fact that practice does not care to keep pace with theory, and for this reason, instead of a station emitting either a pure electrical tone or an acoustic tone, it will be found that much of the apparatus in use is of prehistoric refinement. Sing a clear sustained note into an open piano and you will hear a string of the identical pitch vibrating. Sing a rapidly descending scale and you will hear several strings vibrate. The first method resembles an undampened wave [illegible] actuating a single station; the [illegible] style of dampened waves, [illegible] vicinity. A still graver source of interference [illegible] in a station emitting pure waves that are [illegible] but which are so powerful that they cause every [illegible] aerial to pulsate electrically in their own frequency. For the immediate present, [illegible] seems to be the most practical remedy for this evil.

The pioneer leaders in the adoption and [illegible] of the sustained oscillation system are [illegible] Fessenden in this country, and Valdemar Poulsen in Europe. These two inventors have employed, however, widely different means to obtain the same result. Poulsen has made use of the principles of Thomson's singing arc, while Fessenden has developed alternating current generators which have the remarkable ability of producing from 50,000 to 200,000 alternations of the electric current per second. Alexanderson, of the General Electric Company, designed these machines and they represent a triumph of constructive skill. The heart of the mechanism is a disk rotating at a speed of 20,000 revolutions per minute. Mr. Alexanderson says: "The diameter of the disk being one foot, the peripheral speed is 1,000 feet per second, or 700 miles an hour; in other words, the disk would roll over to Europe in 4 hours." These machines are to-day on the open market, and their general adoption will be a great factor in eliminating much of the present interference. Ernst Ruhmer, the German scientist, believes that the Fessenden method will undoubtedly be the method used in the future for the production of pure electro-magnetic waves. The limitation of the high frequency alternator, however, is due to hysteresis losses in the iron which limits their efficient outputs to long wave-lengths.

Present Success in Avoiding Interference.

The near future of wireless will see improvements following along the general lines of increased range of transmission, and better means for procuring immunity to interference. In the pursuit of selectivity, however, I believe a different course of development will be followed from the lines hitherto adopted. True immunity to extraneous interference is immunity not merely to static atmospheric charges or forced oscillation effects of powerful neighboring stations, but it must be immunity to intentional interference. This phase of interference has been already developed in the German navy, and a machine has been constructed on the principle of a siren. The operation of this machine is somewhat like singing a rapidly descending and ascending scale near a piano. All wave-lengths are momentarily emitted and a tremendous source of interference is produced. The Germans do not interfere with themselves, for they simply omit the note they use from the diapason of the siren. A spark gap placed directly in the antennæ will also produce an equal disturbance. How are we going to avoid the effect of these intelligence destroyers? By perhaps one method, the use of a system operating through the conjoint action of two or more waves of very different characteristics. Tesla shows a system in a patent granted in 1903. Each of his individual waves of different frequency closes a certain relay, and before the final indicating device operates, it is necessary that a number of relays be closed, each by a different individual wave. In order, therefore, to create an interference, it would be necessary to determine the combination of the waves used; and since the possible combinations are infinite, the general theory of the system prohibits intentional interference. The use of relays, however, prohibits the practical use of the system.

Prof. Fessenden was granted a patent in the same year on a system utilizing the same fundamental principles of co-operative waves. He, however, obtained far greater immunity to extraneous disturbances by operating the system not by the electrical frequency of his transmitting station, but by the acoustic frequency or note we have already mentioned. That is to say, a chord of musical notes is produced at a sending station and the receiving station contains only such tuned elements as will respond to this chord. With a detector having no appreciable resistance I have operated this system successfully. De Forest, Stone, [illegible] and others also have patents on systems operating broadly on the principle of co-operative waves. The future selective system of wireless [illegible] in this direction.

(To be continued.)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A New Form of Underwater Attack

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in Mr. Skerrett's article describing Davis torpedo-gun, published under the above title in your issue of August 3rd; but in the last paragraph, in which he describes the results of the tests in [illegible], the writer omits to state whether the [illegible] were fitted with torpedo netting or not.

One can readily understand that the effects of such a [illegible] striking a warship unprotected by a torpedo net would be disastrous; but assuming it were directed against a vessel which had her net out, could the torpedo-gun then do any damage? Is the projecting end of the tripping rod on the nose of sufficient dimensions to be effectually obstructed by the mesh of the net, thereby [illegible] the resistance apparently essential to cause the [illegible] of the shell inside, to be encountered? In other words, is the end of the tripping rod larger than the mesh of the torpedo net? If it is not, is the head of the torpedo armed with any cutting appliance for forcing its way through the net?

From Mr. Skerrett's account, I gather that the tripping rod cannot come into action until an effective obstruction is actually encountered by it. If my reading is correct, and the head of the rod is not larger than the mesh of the net, might not the torpedo simply be caught by the net and lie outside harmless?

Port Elizabeth, Cape. AFRICAN READER.

A Simple Rule for Determining the Direction of Gyroscopic Forces

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to call your attention to an important error in Mr. Pearson's letter (October 26th, 1912) on the gyroscopic action of the Gnome motor in Miss Quimby's aeroplane.

To quote his exact words, your correspondent says (p. 347):

"Take a gyroscopic top. Set it rotating, and hold it in front of you with the axis parallel to your line of vision, so that it revolves clockwise as you look at it, the same as a Gnome motor when seen from the pilot's seat of a Blériot. Turn it sharply to the *left*, trying to keep the axis horizontal. Note that the forward end of the axis dives *downward* in spite of you. Tilt it quickly *up*, and note it swerves to the *left*."

Both of these statements are incorrect. If Mr. Pearson will actually try the simple experiment which he describes, he will find that the behavior of the gyroscope is precisely opposite to that which he predicts. In fact, under the conditions stated, if the top is turned to the *left*, the forward end will *rise*, and if it is tilted *upward*, it will swerve to the *right*.

The fact that an error of this kind can occur in the discussion of so important a case as the fatal accident to Miss Quimby, seems to show that there is still much haziness in the minds of aviators concerning the *direction* of gyroscopic forces. Every one knows, in a general way, that when we attempt to force the axle of a spinning gyroscope out of its position, the axle, instead of yielding perceptibly to the applied force, will move (or tend to move) *in a direction at right angles to the force*. But, unfortunately, there are *two* such directions, and many persons appear to be at a loss to decide between them.

For instance, if we push the forward end of the axle to the left, it will certainly move *either* up or down; but the important question is, which will it be—up or down?

A very simple rule for deciding this question is the following, which was first published by the writer in the *Engineering News* for June 21st, 1910:

Imagine the deflecting force to be exerted by the pressure of a flat board pushed against the spinning axle of the gyroscope, and note the direction in which the axle, if rough, would tend to roll along the board. This will give the required direction of motion for that end of the axle.

This rule is immediately applicable in any position of the axle—vertical, horizontal, etc.—and whatever the direction of the applied force.

For example, in the case cited in Mr. Pearson's letter, a forcible turning of the aeroplane to the left may be thought of as due to a pressure exerted by a (vertical) *board pushing the forward end of the axle to the left*. If the axle is rotating in the direction described, it would tend to roll up the board. Hence the aeroplane would rise.

Or again, consider the case of a side-wheel steamboat, where the axle of the revolving wheels is cross-wise instead of longitudinal. A sharp turn to the left is equivalent to a forward pressure on the right-hand end of the axle. If this pressure is thought of as exerted by a board, it is obvious that the axle would tend to roll *down* the board. Hence the steamer tends to list toward the right. Similarly, if the steamer turns to the right, it will tend to list toward the left. That is, the gyroscopic action of the paddle-wheels, in so far as it has any appreciable effect at all, tends to make the vessel list toward the *outside* of the curve.

The rule is thus seen to be capable of rapid and accurate application to a great variety of cases in which any of the older rules seem liable to leave one in doubt as to the correctness of the result.

EDWARD HUNTINGTON,
Assistant Professor of Mathematics, Harvard University.
Cambridge, Mass.

The Bureau of Chemistry and Its Work

To the Editor of the SCIENTIFIC AMERICAN:

One cannot read the SCIENTIFIC AMERICAN for any length of time without being impressed with the keen practicality, the philosophical insight and the fairness displayed in the editorial writings. To such a reader the recent attacks on the Bureau of Chemistry cannot but be disappointing.

Doubtless the Editor is honest in his attitude, but it would seem that a scientific journal would be careful to present conclusive evidence when making an accusation. What basis has the Editor for his statements that the employees generally of the Bureau of Chemistry are incompetent, that there is no harmony or co-operation among them, and that Dr. Wiley, while fearless and honest, is scientifically incompetent?

The principal argument advanced by the Editor to support his charge that the Bureau is incompetent, is that it was necessary to appoint the Referee Board, to check up the results obtained by the Bureau of Chemistry. Is the Editor so naïve that he believes that the principal reason for the appointment of the Referee Board was because of the alleged unscientific character of the Bureau's conclusion adverse to sodium benzoate? Was not a cry of protest inevitable from the users of preservatives regardless of the scientific character of the Bureau's work? It is certainly surprising that the SCIENTIFIC AMERICAN should base its charges upon the appointment and work of the Referee Board in view of the fact that while the scientific character of the board is not seriously questioned there is no unanimity among physiologists as to its conclusions.

While the Bureau of Chemistry is not composed principally of famous and highly specialized scientists I believe that anybody who really knows the Bureau will acknowledge that the personnel is of a very high order. One need but be slightly familiar with current chemical literature to realize to some extent the quality of work being done by the Bureau employees. It is true perhaps that a large percentage of the work is not of a research but of a routine nature. This must be so, as the great bulk of the Bureau's work is securing evidence of law violations and much if not most of this work requires *routine* examination. This work is required by law. Can the Editor doubt the value of these routine examinations, which lead to the detection of such violations as the addition of wood alcohol to extracts and beverages, or the addition of harmful habit-forming agents to household remedies? This work is well and thoroughly done and the public has reason to be grateful for its protection. Would the SCIENTIFIC AMERICAN do away with this work and occupy the time of the Bureau with such long drawn out and expensive experiments as conducted by the Referee Board, only to arrive at conclusions which are equally indefinite and unsatisfactory?

But the securing of evidence of law violations is not all of the Bureau's work. As an example of the Bureau's desire to use educative means to avoid violations of law take the following instance. It was found that many samples of catsup were being collected which gave evidence of being of unsound, decomposed material. A microchemical expert was sent into the field to visit canneries and observe the practical conditions of manufacture. In his visits to these factories he was not only able to ascertain the source of trouble but by practical demonstrations with the microscope and otherwise he was able to show the manufacturer that he was unintentionally producing unwholesome food. After an entire season of this work the Bureau was in a position to issue useful instructions to the canners. It should be understood that this is only one instance of the Bureau's efforts to educate the public.

But it is the insinuation against Dr. Wiley that is the most unjust of all. The editorial of March 30th, 1912, states that the "Bureau of Chemistry needs a man of such solid scientific attainments that there will be no need of referring his decisions to a Board of Referees." Dr. Wiley's scientific standing requires no defense, but such a statement is so opposed to common knowledge, that it should not go uncriticised. Does the Editor consider Dr. Wiley's recognition by the leading scientific and medical societies of the world as being without significance? The SCIENTIFIC AMERICAN truthfully styles the Pure Food Law "Dr. Wiley's Pure Food and Drugs Act." Could a man secure such a law in the face of great opposition unless he possessed intellectual qualities of an unusual nature?

If the SCIENTIFIC AMERICAN possesses evidence of Dr. Wiley's scientific incompetence, it is its duty to present evidence of same.

I must confess that I am somewhat of a hero worshiper in this connection, as are most men who have ever had the privilege of service under Dr. Wiley. There was certainly no lack of harmony and co-operation under Dr. Wiley's leadership. Almost every man, even to the humblest, was inspired to believe that he was engaged in no ordinary work but was a real factor in the Pure Food fight. If discord occurred within the Bureau it did not come from internal causes but from disturbing causes without.

Riverdale, Md. HENRY E. NORWOOD.

[The rank and file of the Bureau of Chemistry are fairly competent, on the whole competent enough to perform effective work under the direction of able division chiefs. We cannot refrain from pointing out, however, that of the six M.D. degrees which are to be credited to six of the Bureau's men, four were granted by a night medical school, the discontinuance of which was recommended by Abraham Flexner of the Carnegie Foundation on the ground that the curriculum was below the standard. One of these M.D.s was awarded to the man who made the benzoate of soda investigations under Dr. Wiley's direction and who at that time was only a medical student. Is it likely that a doctor who has received his medical education in such an institution can compare with a graduate of Johns Hopkins, for example?

Our correspondent urges that the work of the Bureau was principally routine in character; therefore scientific research does not appear prominently. This is the crux of the whole situation. The Bureau has always had a most liberal Congressional appropriation. Money was not wanting for any work that the Chief of the Bureau and his aids wished to carry out. What institution in our country should carry on scientific research for the purpose of aiding the enforcement of the Food and Drugs Act by studying the scientific questions involved in food manufacture and analysis, if not the Bureau of Chemistry? But such constructive work was not put prominently forward, and the positions of the Bureau were not filled by the appointment of chemists who, by past training and proven ability would be able to do such constructive work.

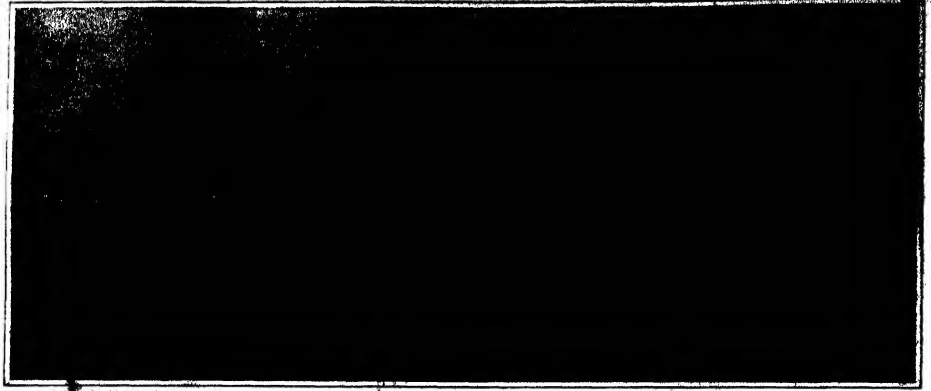
It is evident that our correspondent is not sufficiently acquainted with the leaders of scientific thought in this country. Otherwise he would not believe that the chemists of the Bureau, as well as their former chief, have a high scientific standing among chemists. The benzoate of soda experiments, which Dr. Wiley and those who aided him in the Bureau still persist in regarding as scientifically conclusive, have been repeated by abler chemists with the result that totally different conclusions were reached. Not only did the Referee Board find that the conclusions drawn in the case of benzoate of soda were entirely wrong, but so did Prof. Lehmann of the University of Wuerzburg and more recently Prof. Schattenfroh of the University of Vienna.

These are scientific men who have reputations to sustain. Chemists are more likely to accept their statements than those of Dr. Wiley and those who are responsible for the benzoate of soda experiments. When Dr. Wiley decided that lead (a cumulative poison) could be safely used in baking powder, he revealed not only his own scientific shortcomings but handed down a decision directly against the spirit of the Pure Food and Drugs Act.

One of the division chiefs, whom our correspondent regards as a man of high scientific standing, drowned instead of poisoning rabbits (as he supposed) by running a tube into their lungs instead of into their stomachs, during the course of experiments intended to show that caffein contained in the quantities found in a popular beverage is highly dangerous. During the same experiments rabbits were permitted to contract a contagious mange because the Bureau of Chemistry men had no experience in handling animals. Surely such men are not competent to conduct research work.

In common with every other fair-minded journal in this country, the SCIENTIFIC AMERICAN regrets the appointment of the Referee Board. But it also recognizes the necessity of that appointment, because the Bureau of Chemistry is either unable or unwilling to conduct its investigations in a scientific spirit. Had the Bureau done its work well in the first place, we would never have heard of the Referee Board.

Lastly, we have no desire to belittle the work that the Bureau does in conducting routine examinations that lead to the detection of wood alcohol in extracts and beverages or of harmful habit-forming drugs in household remedies. This is scientifically rather unimportant work. What we expect of the Bureau is not simply analytical work but research of a fine type to determine the physiological effects of substances on which there is practically no literature; research, in other words, that involves high experimental ability. That is the most important function of the Bureau, and in the performance of that function it has failed.—EDITOR.]



All photographs by American Colony, Jerusalem.

Mersina, port of Adana, where much material for Bagdad Railway is landed.

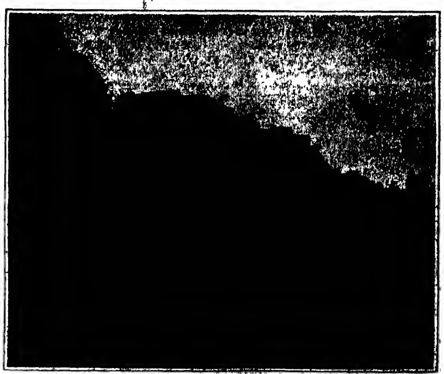
The reign of the Turk in Europe is over. His future lies to the east of the Bosphorus and the Dardanelles, in that land of history and fable which is about to be restored to more than its one-time prosperity by the coming of the railroad and the irrigating ditch. Very timely is the following story, by an eye-witness, of the construction of the Bagdad Railway.—EDITOR.

THE lines of the Bagdad Railroad having now been successfully laid from Aleppo eastward to the Euphrates valley, calls attention to this daring enterprise which will link Mesopotamia with Europe by an iron road, and, incidentally, the sacred cities of Palestine as well. At the moment an army of 72,000 men are at work upon the railroad, and during the last two years much has certainly been accomplished. Aleppo, in Northern Syria, has been converted into a great railroad-building center. Indeed, it is the principal base of operations, and huge quantities of railroad material have been collected here. Locomotive works and repair shops have been built as well as large temporary barracks for the workers. On what is known as the Aleppo section there are now five hospitals with ten doctors and many nurses who attend to all cases of accident and sickness among the workers free of charge.

This activity on the much-discussed undertaking is the more extraordinary when it is remembered that from October, 1904, until the latter part of 1909 not a yard of steel was laid or a spade put into the ground. The reasons for this long delay were certainly many, and to properly appreciate them it is necessary to briefly review the history of the Bagdad enterprise. It was in January, 1902, that a Franco-German syndicate obtained a concession from the Turkish government to build a railroad from Konia, the terminus of the German Anatolian Railroad in Asia Minor, to the Persian Gulf, a distance of 1,460 miles, or 1,870 miles from Scutari, the Asiatic suburb of Constantinople on the other side of the Bosphorus. The work was to occupy eight years, provided the money was forthcoming, and it was estimated that the line would cost about $100,000,000 to build. It soon leaked out that the syndicate was a group of German financiers, with the result that British statesmen did not regard the enterprise at all favorably, more particularly as its ultimate object was to tap the Persian Gulf. This was but natural, for eighty-eight per cent of the trade of this region is in the hands of the British. The British argument was that she had spent blood and treasure freely in opening the Gulf to trade and that the maintenance of British supremacy there was an integral part of her Asiatic policy.

Again, Great Britain recognized that the syndicate, or rather the Germans, had the best of the bargain. Turkey was to find the money and the Germans were to build the railroad with German material and by German engineers. In 1903 a practical start was made. The Turkish government handed a loan of $9,500,000 to the syndicate for the erection of the first section of the road. Instead of costing this sum to build only $3,000,000 was expended. There was a clear profit on the construction of $6,500,000. This first section of the

One of the famous Naupas water-wheels of Hama.

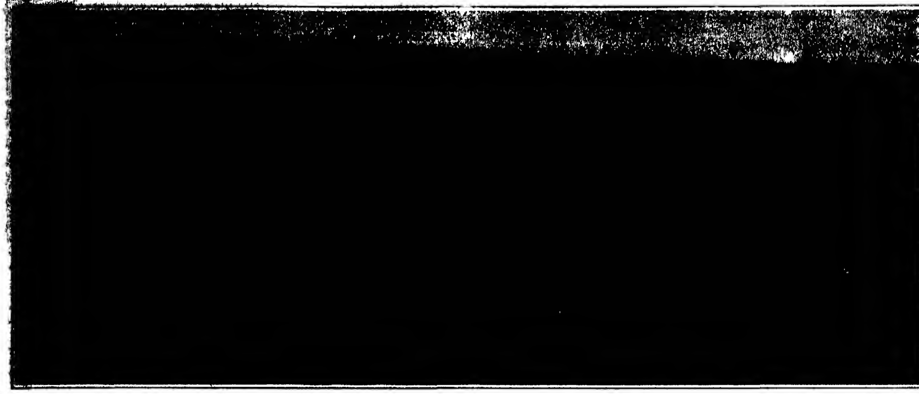


Castle at Tripoli, taken after five years' siege by Count Raymond the crusader, in 1104.

Bagdad line runs over a dead level plain, and crosses only one small river. So construction was done as cheaply as it could possibly have been. Section number two, however, traverses the Taurus Mountains, and it was discovered after careful survey that $15,000,000 would be needed to carry the rails over this route. The financial arrangements being the same as before, Turkey was prepared to find $9,500,000, but this was not sufficient; while it appears that a large proportion of the profits made on the first section had been distributed among the shareholders of the syndicate. The result was several years delay, caused principally through the want of money and also by political and other disturbances in the Turkish Empire, to say nothing of the action of Great Britain in demanding that her rights in the Persian Gulf be safeguarded. The upshot of all these discussions was that the Germans not only got over the money difficulty, but obtained loans from the Turkish government amounting to $37,500,000 to enable them to carry on the work over more than one section at a time, while England was provisionally satisfied by an arrangement by which the line from Bagdad to the Gulf should be built by an English company and be purely international in management.

Having briefly outlined the reasons for the long delay, let us glance at the work now in hand. The enterprise has been divided into four sections, the first extending from Konia to Adana, the second from Adana to Aleppo, the third from Aleppo to Mosul on the Tigris, and the fourth from Mosul to Bagdad. As already explained, an English company will carry the lines from Bagdad to the Persian Gulf, and this section is to be purely international in its management. To discover how the work was progressing, the writer, in company with some photographers of the American Colony in Jerusalem, journeyed north from that city to the seat of operations, visiting Aleppo and tramping eastward over the partially completed road toward the Euphrates. We also made excursions to Tripoli, Alexandretta and Mersina, the ports to which the material for the building of the road is brought. Speaking generally, the officials were very reticent about giving information, though no objections were raised to our visiting the workyards and taking photographs.

Over the three sections stretching from Konia to Mosul, an army of 72,000 men is at work. From Konia the line is already opened to traffic as far as Ulukishlar at the very foot of the Taurus Mountains. The lifting of the track over these mountains and dropping it down again into the Cilician Plains on the other side is proving a very arduous piece of work. However, capable engineers are grappling with the difficulties and they should be overcome within

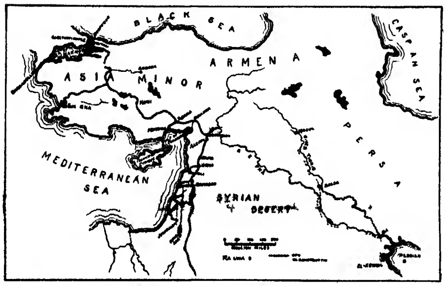


Homs, one of the largest cities on the French Beyrout Aleppo Railway The roofs of the houses made of mud and straw The new (French) houses in fore ground are tile roofed

the next two or three years There are some particularly deep chasms to be spanned and much blasting away of rocks to provide a bed for the track Meanwhile the track is being rapidly laid from Adana westward toward the Cicilian Plains as well as eastward in the direction of Aleppo For some months past material for this section of the road has been sent up over the short line from Mersina a small port on the Mediterranean in Asia Minor to Adana. This railroad was built some few years ago by the French but has now been purchased by the Germans.

Then from Aleppo the principal base of operations the builders have pushed eastward toward the Euphrates which has now been reached and northward to Osmaniyeh on the way to Adana. The activity at Aleppo is remarkable A few years ago it was a sleepy old world Syrian city Now all is bustle and activity At the present time building material is being brought here for the railroad over the French line from Tripoli From this port a train of twenty to twenty five cars of railroad building material reaches Aleppo daily Soon the erection of an imposing station will be commenced at Aleppo to cost over a million Turkish pounds Aleppo is not on the main line but Moselmieh a little distance to the north will be the junction of this great system of Asiatic railroads But all trains will go to Aleppo over the short branch line connecting it with the junction Then within the next few weeks the erection of a temporary wooden bridge over the Euphrates will be put in hand so that the rails may be laid with all possible speed to Mosul Much of the embankment along the route here has been already made The temporary bridge over the Euphrates will be replaced

on page 446

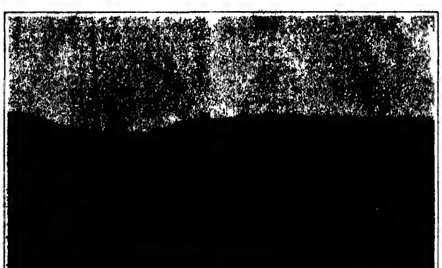


Map showing route of Bagdad Railway

Lumber for the temporary Euphrates bridge. Note fine track

Train from Aleppo arriving at the Homs station

The old way.



A 'dirt train, Bagdad road, near Aleppo.

An oriental double-decker

Vacuum Cleaning Attachment for Automobiles

A VACUUM cleaning attachment for automobiles has recently been invented. It is operated by the exhaust gases from the engine by passing them through a suitably designed nozzle and vacuum chamber. The principle of operation may be likened to that of the injector as used with the steam boiler. The exhaust gases create a suction in the hose as they leave the nozzle and pass the opening in the vacuum chamber. Any dirt or dust will be picked up by the cleaning tool or brush and discharged to the atmosphere through the exhaust tube.

The device is installed on the car in the same manner and place as the ordinary muffler cut-out valve. This is accomplished simply by cutting out a short section of the exhaust pipe ahead of the muffler.

The invention renders it possible to finish a long day's run over dusty roads clean and free from dust. Clothes as well as the car can be cleaned.

Vacuum-cleaning an automobile.

The exhaust gases of the motor create the suction.

Back Rest for Locomotive Engineers

WHILE almost everything possible has been done by different railroads for the benefit of the traveling public, very little thought has been given to the man at the throttle, sitting for hours in a narrow cramped position, his mind taxed to the full limit, his body at a terrible strain. The percentage of deaths from Bright's disease and other kidney disorders is very high among locomotive engineers, and it is claimed that this is due in large measure to the continued jar of the engine. With a view to ameliorating these conditions, an inventor hailing from Montgomery, Alabama, has invented a portable back rest, a view of which is shown in the accompanying illustration. The back rest is made of canvas, which is attached to the seat, while the upper end is secured to coil springs, which are hooked to the ceiling of the cab. The springs relieve the engineer of a great deal of jarring, permit him to occupy a much more comfortable position, and consequently make him more efficient, particularly on long runs. The back rest may be rolled up into a small package, weighing altogether less than a pound and a half. The device has already been put to the test of actual service on the Louisville and Nashville Railroad, and has been heartily indorsed by the engineers.

Back rest for locomotive engineers.

A New Slot-machine Camera

THE new automatic photograph machine which we here illustrate is an example of great ingenuity as applied to its conception, as well as a most careful working out of all the details. It is the invention of H. Ashton-Wolff, an electrical engineer, who succeeded in completing it at Paris after many years' work. It is a coin-operated machine which uses electricity throughout, and one of the main points is that instead of the old-fashioned tin-type, it gives an artistic portrait upon a platino-bromide postal card. It appears that this is the first time that an entirely automatic machine is able to make an attractive and durable photograph of this kind, and in fact the new apparatus is attracting much attention and is considered a great advance upon what has been heretofore produced.

In order to take the photograph, the person inserts the proper coin into the slot and from there it drops down behind a small glass screen, where it remains visible during the process, only falling into the cash box when the finished picture is delivered. This is a good means of obliging the public to use real coins, for the inserted coin being in plain view is seen by the bystanders, etc. As the coin is inserted the machine starts, a bell rings and a sign becomes luminous containing a red cross to fix the attention. Next it is a small mirror arranged like the finder of a camera, which shows the sitter if he is in the center of the photograph. Proper directions for this are given in an inscription placed on the machine. An artificial light comes into action as well as a bell and a second electric sign requesting the sitter not to move. The exposure, which is instantaneous, takes place, then the light goes out and another luminous sign indicates that the sitter can leave the apparatus and wait for the picture to be delivered.

After the exposure is made, the photograph card drops down into a closed ebonite dish, into which the developing solution flows, this coming through ebonite tubes. As soon as the card is developed—and it is to be remarked that it develops a positive picture instead of a negative by means of new chemical processes which have been discovered after long research—the developer flows out of the dish into a waste tank below, so that each photograph receives a fresh bath. All the photographs are similar, because they are treated alike. Ordinary water flows down into the disk in order to rinse the card. After that it is fixed in the same dish by a special fixing chemical. It is then washed and all the chemicals are well eliminated. The dish in which all these operations take place then opens below, and the finished card drops down into a drying device, which dries the photograph by whirling it centrifugally. This special device is a new invention and dries the picture without softening the gelatine, as is remarked in the case of heat dryers. The photograph is thus dried in fifteen seconds. Electromagnets are then brought into play to stop the dryer, and when it is at the full stop it comes into a vertical position and the finished card drops out through a slot and is delivered.

All the parts of the apparatus are so arranged that should a leak ever occur, the chemicals cannot by any means reach any working parts of the device, but are forced to flow into a protective ebonite tank and from there down into the waste tank.

To bring about all the movements of the electric devices in the proper manner, a rotating contact device or distributor is used, which is a fixed disk of insulating material having upon it [illegible] the manner of a controller [illegible] carrying sets of brushes so as to [illegible] and close the circuits of all the [illegible] in the proper order. A small electric motor [illegible] arm around the distributor, and one [illegible] to make all the contacts.

Should by any chance anything go wrong [illegible] machine and no photograph be delivered, [illegible] has until now remained in full view of [illegible] returned to him instead of dropping into the [illegible]. A very strong artificial light for the exposure [illegible] tained by the use of over-volted incandescent [illegible].

The machine furnishes one hundred postal [illegible] traits on a single charging, and is worked [illegible] electromagnet devices combined with electric [illegible] so that there are no springs, cams or levers [illegible] apparatus. All the photographic solutions [illegible] for at least one month. Each of the parts is a [illegible] mechanism which can be taken out at once, [illegible] wires need be detached, as all the contacts are [illegible] spring pieces. About ten minutes are needed for recharging the machine. The value of the apparatus is increased by the use of special devices for electric [illegible] signs which can be readily applied in any combination. As the photograph comes out, a luminous hand [illegible] the sitter's attention to a second slot, and dropping a cent into it secures a transparent envelope for the postal card view.

The apparatus closed.

The apparatus open.

New slot-machine camera.

An Early Type of Cotton Raised in the United States by the Hopi Indians

THE origin, growth and development of the cotton industry in the United States has received considerable attention from historians, ethnologists and statisticians. Much interest has been manifested in the identity and description of the varieties which formed the foundation of the American upland cotton, but only recently has there been a systematic study and analysis of the types of plants which make up the field crops to-day, with a view of accomplishing this object.

Although it is difficult to ascertain the actual extent of the influence of native species of cotton on the character of the present-day types, it is felt that they have been influenced more by the importation of tropical and European cottons than by any original American ones. With a view of elucidating the history of one form of native cotton, Mr. Frederick L. Lewton, of the U. S. National Museum, has written a pamphlet entitled "The Cotton of the Hopi Indians: A new species of Gossypium," forming publication No. 2146 of the Smithsonian Miscellaneous Collections.

The fact that cotton was used and of necessity cultivated by the Indians, is recorded by several early Spanish explorers, as it has been more recently by many ethnologists. In the villages of the cliff-dwellers of Mesa Verde National Park numerous fragments of cotton cloth have been unearthed, and in Utah the seeds of the plant itself have been found.

To-day, among the Hopi Indians of Arizona, the cotton plant is highly esteemed, and its fiber enters into many of their ceremonies, as well as into many practical household activities. It is considered essential by them that all strings employed in religious services be of native cotton. These strings of cotton are used to bind together prayer sticks and offerings of all kinds, and are placed in the trails entering the pueblos where ceremonial services are in progress; the badges of the chiefs are all wrapped with native rough-spun cotton strings; and cotton is also used to weave ceremonial kilts, belts and blankets.

Unfortunately the native Hopis, once deft in the art of weaving blankets, mantles, rugs and other articles from cotton, now find it far easier to purchase either the yarn already spun, the cloth already woven, or the complete garment, and thus the art is gradually being lost. Cotton is still cultivated by them, however, to a small extent, in a village in the Western Navajo Reservation, and in one of the Moqui.

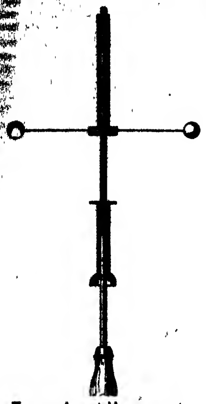
The Department of Agriculture has carried on experiments with Hopi cotton for the past seven years. This particular species of cotton is remarkable for the rapidity with which it grows and the early date at which it blooms, it being the earliest to blossom of several hundred species put to test.

As to history and development of this particular sort of cotton, Mr. Lewton describes botanically the distinguishing features of a new species which he calls Gossypium hopi, and which is illustrated by five plates showing the growing plants, the flowers, and the maturing and ripe bolls.

[illegible] Portable Anemometer

By Albert [illegible]

[illegible] has created a demand for portable in[illegible] for ascertaining the velocity of the wind. [illegible]ment of this sort which is adapted to be [illegible]ection with a watch, preferably a stop-[illegible]strated in the accompanying engraving. [illegible] a thin brass rod provided with a suitable



Home-made portable anemometer.

handle. The rod is divided into three sections; the section nearest the handle is unthreaded, the middle section is threaded, and the outer section is graduated, but not threaded. Mounted on the threaded portion is the rotary part, consisting of a nut provided with four arms terminating in small cups after the fashion of the common anemometer. The cups must be so positioned that their convex sides will be in advance as the nut follows its spiral course down the rod. The nut carries a sleeve which is of exactly the same length as the graduated portion of the rod, so that when the nut is at the top of the threaded portion, the end of the rod will be just covered by the end of the sleeve. In this position the nut may be held by means of a set sleeve which the operator slides up against it. When it is desired to measure the velocity of the wind, the anemometer is held in such a position that the wind has unhampered access to the cups of the rotary part. Then the set sleeve is retracted and the anemometer is permitted to revolve and pursue its slow spiral course down the rod. At the end of ten seconds this motion is checked by means of the set sleeve, and then the graduated portion of the rod projecting above the sleeve carried by the nut will indicate the velocity of the wind in feet per second or miles per hour, depending upon the nature of the graduation. The rod may be graduated by comparing it with a standard anemometer or by carrying the instrument on an automobile at fixed speed through still air.

Method of Making Selenium Cells

By Philip Edelman

SELENIUM can now be obtained in fused sticks or plates at about seventy-five cents an ounce. It is prepared from compounds of selenium which are found in the dust from furnace flues where sulphides are burned in the manufacture of sulphuric acid. This is oxidized to selenious acid, which is treated with sulphurous acid to give selenium. It thus forms a valuable by-product of what was once thrown away as useless.

Selenium exists in two allotropic forms, a red amorphous powder obtained as above and a dark gray mass obtained by melting and suddenly cooling this red powder. In addition to these, crystalline forms are obtainable by heating the gray solid form of selenium in semi-inclosed vessels with varying amounts of air. These are usually either white or pink. They may be obtained by heating a portion of the gray solid selenium in an evaporating dish, covering or partially covering the dish with a clear piece of glass. Care must be taken or else the glass plate will crack. The crystals form on the glass plate. By varying the opening and supply of air different effects are produced. The red poisonous fumes which arise from the melting selenium are an oxide of selenium, which may be collected by holding a glass plate at some distance from the evaporating dish, where the vapor condenses on the glass plate. Little gray-black globules of selenium collect on the inside of the evaporating dish.

Construction of selenium cell.

Chemically, selenium acts very much like sulphur. Heat is necessary for nearly all its actions with other elements. It has a very strong affinity for lead, tin, and zinc, and when a little of either of these metals is thrown on some melted selenium, some pretty fireworks take place and a selenide of the metal is formed. None of the acids acts very energetically upon selenium. The gray solid form is insoluble in carbon disulphide, but the amorphous form is soluble in it.

The gray solid form is the only one which is suited for electrical use. As it comes in sticks or plates it has a very high resistance, and is indeed almost an insulator. This is not so strange when we consider its close relation to stick sulphur, sulphur being one of the very best insulators known. Indeed, it was discovered that the resistance of selenium varied with the light to which it was subjected, while it was being used as a resistance for telegraph work.

The essential points in a selenium cell all hinge upon obtaining a very thin film of selenium on some closely adjacent conducting wires. After countless futile trials the cell shown in the drawing was constructed. Its dimensions were 1 inch by ½.

A piece of clear mica ½ inch wide and 1 inch long is cut out, and beginning ¼ inch from one end two separate enameled copper wires are closely wound until within ¼ inch of the other end. The writer uses No. 40 enameled wire for this purpose, although No. 24 B. & S. enameled wire has been used successfully in the same way. The enamel is then very carefully scraped off the copper wire by means of a very fine jeweler's file until the metal shines through. This grid is now placed on a spoon or other holder and heated. When heated some selenium is quickly and evenly rubbed on it from a stick of selenium. Since the selenium melts and flows like sealing wax this part is not difficult. The grid is then quickly placed on a smooth flat surface and a small piece of clear glass ½ by 1 inch pressed down upon it with heavy pressure. This method insures a very thin film of selenium, which will adhere permanently to the grid. It should be so thin that it is semi-transparent. The glass piece is left on the grid permanently. The cell is then placed in an oven where it is allowed to bake at an even temperature just below the melting point, for several hours. It should then be taken out and suddenly cooled. The whole operation is a delicate process, but once mastered the making of the cells is simple. Connection is made to the ends of the two fine wires. The cell should be mounted so that the light can reach it from all sides.

The cell when constructed will still have considerable resistance, so a battery of a number of cells will be necessary. When proper pains and care are taken a cell sensitive enough for all ordinary experiments will be the result.

An Improved Phosphoroscope

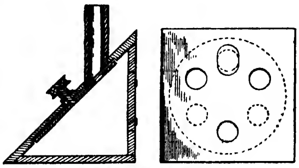
By Walter C. Belcher

POSSIBLY no easily constructed scientific instrument will afford more entertainment than a phosphoroscope; yet not one instrument maker in fifty would know what was desired were one ordered from him, nor does one often see them in physical laboratories. The instrument will amply repay the little time necessary for its construction, and will furnish an ever-varying display, rivaling an endless variety of Geissler tubes, and, furthermore, no batteries, coal, or static machines are required. Nearly all substances are phosphorescent to a degree; calcium sulphate (luminous paint) being probably the best-known example on account of the duration of its "discharge" or glow. In order to know if a substance has this property, we must expose it to light and then examine it in the dark. Obviously, if the duration of its glow is very short, we could not do this unless an instrument designed for this purpose were at hand.

Becquerel devised such an instrument, consisting of a drum or box which has an opening in each end. In this drum revolve two disks mounted on the same axle and pierced symmetrically with the same number of holes. They are mounted close to the ends of the drum, and are so adjusted that when a hole in one disk is opposite the hole in the corresponding end of the drum, the second disk closes the hole at its end and vice versa. The object placed in the drum for examination is thus exposed to light and to the eye in as rapid succession as may be desired when the axle is revolved.

The writer prefers an instrument having only one fixed and one rotating plate, pierced symmetrically with the same number of holes, except that the fixed plate has an additional hole at the same distance from the center as the rest. In this hole is inserted a tube serving as a sight tube, which should be made of sufficient length to allow the eye to focus easily on the object to be examined. A small electric motor direct connected provides a neat way of driving

One application of this instrument which the writer believes novel is its use either with or without a microscope in the determination of obscure particles in crystalline rocks; and doubtless many other applications would probably be found. Coral, lime, glass, sulphate of quinine solution, etc., are beautiful objects. A



An improved phosphoroscope.

key to phosphorescence is given in the fact that the "glow" of an object is always the color absorbed when viewed by direct light

A Finder for a Three-inch Telescope

By Ralph D. Rust

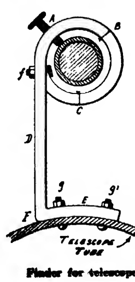
IT often takes considerable time to locate a small object when one is using a high-power eyepiece. A finder such as dealers sell for this purpose offsets the difficulty, but the price is often quite beyond the possibilities of a boy's pocket book. A small telescope can be purchased for two or three dollars, but perhaps one much cheaper and just as efficient may be found in a second-hand store.

When a suitable glass has been obtained remove the first set of lenses in the eyepiece tube and thus convert the terrestrial telescope into an astronomical one. This will make the instrument from 3 to 6 inches shorter.

Procure two strips of brass 5/16 inch wide, 3/32 inch thick and 10 inches long, six brass set-screws, and six 3/8 inch brass bolts. Take one of the strips first; flatten one end of it, and bore a bolt-hole in it. Measure the distance around finder tube; measure off this distance on the brass strip starting from the center of the bolt-hole, and add enough so that when the ring is made its diameter will be at least ¼ inch more than that of the finder. Bend the strip as shown in the drawing, bore a hole at f and secure the ring with a bolt. Mark off points A, B, and C on the ring at equal intervals, and drill and tap the holes for the set-screws. Bend the strip at F. The part D should not be more than 3 or 3½ inches long or it will vibrate too easily. Drill holes at g and g' in the foot E and bend the foot so that it will fit the telescope tube snugly. Bore holes in tube and bolt the foot as in the drawing.

The second support is made in the same way, except that the ring need not be so large, for it should fit over one of the draw pieces of the finder. The rings of both supports should have their centers in a straight line parallel with the axis of the telescope.

The finder is adjusted by moving the set-screws about until a distant object in the center of the field of the large telescope appears in the center of the finder field. This device is not expensive and saves considerable time and trouble.



Finder for telescopes.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Another Substitute for Pneumatic Tires

THE effort to find a satisfactory substitute for the pneumatic tire has resulted in scores of inventions covering all sorts of combinations of mechanical parts. The principal difficulty with most of these inventions lies in the fact that they do not distribute the shock over the entire wheel as does a pneumatic tire. When the wheel runs over a stone the impact is concentrated upon those parts which are in immediate contact with the stone, putting them to such a severe strain that sooner or later they must break. In the case of pneumatic tires, however, the compressed air distributes the load over the entire tube, so that the whole tire assists in withstanding the shock.

Recently a new form of pneumatic tire substitute has made its appearance which depends not on springs or pneumatic plungers, but on the resiliency obtained by pliable bands under tension. With a tire of this sort the blows occasioned by striking a stone are not localized, but are distributed over a third or more of the circumference of the wheel.

Fig. 1 shows the tire being assembled on the wheel, also the tools used in mounting it on or removing it from the rim. Normally when the tire is fully assembled an annular guard plate covers the inner tension band. It will be observed that there are three sets of bands. The outer band has a heavy rubber face to give a good tread surface. The body of the band, however, consists of layers of specially prepared canvas. A portion of this tread surface is shown in the insert in Fig. 1. Riveted to the inner surface of this band are a number of aluminium cups arranged in pairs. These are adapted to fit over aluminium blocks projecting from the intermediate part of the tire. This intermediate part (see Fig. 3) consists of two bands made up of canvas layers and connected by tubular blocks which are riveted fast. Intermediate of these blocks on the outer band are the aluminium blocks just referred to, which are adapted to fit the cups on the tread band. A similar set of blocks is attached to the inner periphery of the inner canvas band, and these blocks are arranged to enter cups secured to the rim as shown in Fig. 2. The rim is provided with lugs between which these cups are fitted. Each of the cups is formed with a head at one end to prevent it from being displaced endwise from the rim. The blocks are alternately disposed as indicated in Fig. 2.

When applying the tire the cups are first removed from the rim, then the tire is assembled with the tread in place, and is slipped upon the rim of the wheel. This done, every second cup is slid into place, the bands being raised successively by means of a pair of tools, as shown in Fig. 1. The tools consist of flat bars with the ends turned at right angles, so that by slipping the flat side of the bar under the canvas and then turning the bar at right angles, a powerful lifting action may be secured. After every second cup-shaped block has been fitted into place, the intervening blocks are introduced, making the tire cling very tightly to the rim. Now when the tire rides over a stone, the bands are flexed, increasing their tension, and, owing to their resiliency, causing them to yield to a certain extent. The aluminium bearing blocks on the middle portion of the tire are cylindrical in form, so that they can turn in the cups and yield in this way to the deformation of the tire. The elasticity of the canvas band causes the tire to return at once to its normal condition on passing the stone.

Tires such as these have already been introduced in England, and they are now being demonstrated in this country. The tire is adapted not only to pleasure vehicles but to motor trucks as well. In the latter case, however, instead of using canvas bands, the bands are made up of steel links and a heavy rubber block tread surface is provided.

It will be evident that if the bands stretch the slack will immediately be taken up by the weight of the car on the wheels. No harm is done by riding with slacked wheels as long as the slackness is kept below a certain maximum. The tension of the bands may be regulated by introducing aluminium shims under every cup on the rim and subsequently, if necessary, under every rim.

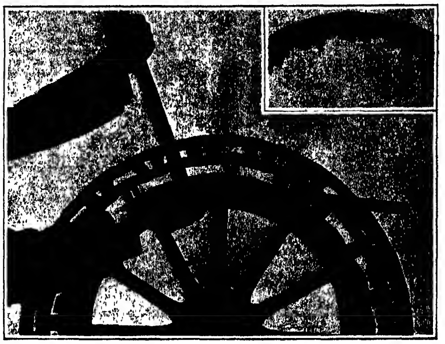


Fig. 1.—Method of introducing the rim cups. The insert shows a part of the tread band with the bearing cups.

Fig. 2.—A portion of the rim, showing two of the bearing cups in place.

Fig. 3.—The intermediate part, made up of canvas bands rivetted to aluminium blocks.

New Kind of Eyeglasses Made With Telescopic Lens

By Dr. Leonard Keene Hirshberg.

DR. K. L. STOLL, of Cincinnati, has devised what has proved to be a revolutionary method of correcting poor eyesight.

During the first quarter of the nineteenth century, the telescopic spectacles were used for high myopia, or nearness of sight, but their theory had not been worked out mathematically. This was later performed by Dr. M. V. Rohr, who demonstrated theoretically and by experiment that they may be used with advantage.

In near vision the myope w[illegible] the objects closely to the eye [illegible] to gain larger images. However [illegible] very comfortable, for the image[illegible] to the eye than the objects in pr[illegible] the strength of the concave glass[illegible]. These persons prefer to read without [illegible], because they thus obtain larger re[illegible]ges and a better angle of distinct[illegible]. But they are exposed to two dangers; [illegible] lose their binocular vision or incre[illegible] myopia by complications resulti[illegible] being too close to the objects. The [illegible]tion will safeguard against the latt[illegible]ger. The following disadvantages [illegible] rection with glasses are to be consi[illegible]: (1) The usually-worn biconcave glass[illegible] not allow correction of astigmatis[illegible] oblique bundles. As a result of thi[illegible] field becomes so ill defined at a small distance from the center of the glass that it cannot be used for distinct vision. (2) The field of vision will assume a "barrel shaped" distortion toward the margin of the glass. This is of very special importance. Fig. 1 shows the picture of a landscape. Only the small central portion is well defined, and the outside is misrepresented. This is held responsible for most patients' to wearing strong concaves. Elevations and vibrating motions may cause headache, uneasiness and dizziness.

The operation will eliminate astigmatism of oblique rays and distortion, and will reduce these two disadvantages in patients who are compelled to wear glasses so greatly that they need not be considered.

At present, however, after an experience of about twenty years, the operation is considered to be dangerous and used only in a limited number of cases, especially in those where correction with glasses cannot be obtained.

Nevertheless, the consideration of binocular vision, the degree of the myopia, the age of the patients, and the existing complications will limit the result of the operation to such an extent that a substitute seems desirable.

The images of objects may be enlarged by telescopes as the only means to enable a myopic person to see well at a distance. The weight, reduced field of vision, and clumsiness of the glasses, however, limit their usefulness. A much more perfect instrument is the *Fernrohrbrille*, or telescope spectacles, consisting of a combination of a convex objective with a concave ocular. It has to be fitted to each individual case with special consideration of the turning point of the eye and the attempt to produce as large a field as possible.

These spectacles were applied to a patient, and he was advised to walk toward the Snellen alphabet from a distance at which he could not recognize them until he was close enough to see them distinctly. The letters were hung up in various positions, so as to entirely eliminate the aid of memory. The light was always the same, and the examination took place each time after an equal adaptation to light, lasting half an hour.

The visual field was taken only in the horizontal meridian, using a large goniometer of five-meter radius, the center of which the patient had to look at with his head fixed. After this the types (Snellen's hooks) were removed to a point where the patient, still keeping his head steady but just moving his eye sideways, could not see them plainly any longer. The latter results were more satisfactory as to vision than those shown in the former. This is caused by the greater accuracy of the method and the types employed.

Herewith is a photograph of the "telespecs." They remind one of automobile goggles, although they are not as conspicuous.

In conclusion it is hoped that with their aid new points may be gained for the study

Eyeglasses with telescopic lenses.

Magnified view through telespecs.

... of myopia and the ... of complications.

... for Inventors

...Pump Valve.—In patent No. ...166 Hugh H. Riley of Memphis, ..., shows a pump valve with which ... connected curved vanes whose outer ... are disposed in the same vertical ... as the outer periphery of the valve, ... vanes being adapted to rotate the valve ... the latter is reciprocated.

A Food Package Made of Cheese.—A ... York city man, James A. Kavanagh, ... secured a patent, No. 1,042,119, for ... food package which is defined as con... of a small section of cheese adapted for retail distribution and a paper wrap... perforated at suitable points to provide vents for the escape of the gases created by the fermentation of the cheese.

Phonograph Improvement.—John H. J. Haines of New York city has secured patent No. 1,042,110 for an improvement in phonographs or similar talking machines in which there is a combined recording and reproducing head combined with a weight which may be shifted to and from the head so as to adapt the head for use as a reproducer or as a recorder.

A Neckless Glass Globe.—In patent No. 1,041,886, to Harry A. Schnelbach, Crafton, Pa., assignor to Jefferson Glass Company, of Follansbee, W. Va., is shown a neckless glass shade or globe with an opening at the top. A separate neck extends through the opening and has its lower end enlarged and is also provided with outwardly extending projections on which the shade rests in such manner as to provide a space between the shade and the neck, the neck having means for engagement by the shade-holding devices.

Locating the Source of Sound.—A so-called locophone has been patented, No. 1,035,920, by Frank Della Torre of Baltimore, Md., for a method of determining the direction of a sound wave or of locating a source of sound, and in doing this the waves emanating from such source are divided and the divided parts are compared by bringing first one part and then another through a common conductor. He employs an apparatus including two diametrically opposite receivers, the direction of the source of the sound waves being determined by stopping one of the said receivers, thus indicating into which of the receivers the particular sound wave was received.

Automobile Improvement.—Many roadsters are supplied with a single back seat after the fashion of a rumble. Ordinarily the engine and chassis of this type of machine are adapted to as heavy a load as those of a five or six passenger car. It is believed some provision can easily be made to supply seats on opposite sides of the rumble by means of a suitable frame carrying the extra seats at its ends and attachable to the single or rumble seat. The problem will involve easy application and removal, security when applied, freedom from rattling when in place and out of place, and the provision of proper foot-rests for the occupants of the extra seats.

Brain of a Patent Expert.—In a recent publication Dr. Edward Anthony Spitska, the brain specialist of Philadelphia, is reported to have credited the late Edward H. Knight with having the largest American brain of record. Mr. Knight was well known, especially in Washington city, where prior to his entry into the Patent Office he was connected with the office of Munn & Co., and was occupied in the preparation and prosecution of patent applications. At the same time he was busy with the preparation of his Mechanical Dictionary. He entered the Patent Office January 1st, 1872, and remained in such office until August, 1876. Mr. Knight's brain with a weight of 1,814 grammes compared well with that of Turgeneff, Russia's poet and novelist, at 2,012 grammes, and said to be the heaviest of record, and the next heaviest recorded American brain, that of Gen. B. F. Butler, the weight of which is given at 1,758 grammes.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

REMOVABLE HEEL.—L. KALINA, care of Midget Manufacturing Co., 38 Duane St., Room 410, New York, N. Y. This improvement relates to heels for shoes, and an object is to provide a shoe having a replaceable heel of leather, rubber or composition, so that even a person unskilled in the art may readily remove a worn heel and replace the same by a new one.

Of Interest to Farmers.

ROLLER HARROW.—J. E. CARLSON and G. J. NASON, Box 14, Rosedale Rural, Bakersfield, Cal. The invention relates to harrows in which rollers are provided with fingers so arranged as to harrow the ground. The invention provides means for clearing the rollers of trash, since the effectiveness of the roller harrow is greatly lessened by the collection of weeds and trash on the teeth.

Electrical Devices.

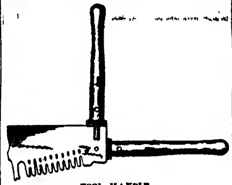
TELEPHONE ATTACHMENT.—D. W. LEPPERT, 1045 3rd Ave., Manhattan, N. Y., N. Y. In this case the invention refers to an attachment adapted to be secured to a telephone instrument, so that a strip of writing material, such as paper, can be unrolled, and any conversation coming over the telephone taken down.

Of General Interest.

CUSHIONED HORSESHOE.—G. E. MCKINNON, Little Falls, N. J. This invention comprises means for cushioning the footfall of the animal wearing the horseshoe. This end is attained by detachably securing to the under side of the shoe a strip of rubber or other suitable material, which forms a resilient tread for the shoe.

Hardware and Tools.

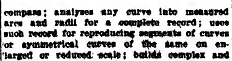
TOOL HANDLE.—ARCHIE MCDERMID, Deming, New Mexico. This invention provides a handle for use on saws and other tools, and is arranged to permit the operator conveniently to attach the handle to the tool in any position to suit the convenience of the user of the tool. As shown in the illustration,



TOOL HANDLE.

the saw is provided at the end with two handles alike in construction. Each of the handles proper contains a nut engaging a screw rod. The flattened end of the rod carries a lug adapted to engage an aperture in the saw. When the handle proper is turned the screw rod draws the saw up against a grooved bearing mounted on the end of the handle.

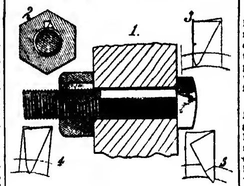
DRAWING INSTRUMENT.—J. W. WHALEN, Graymont, Ill. This instrument permits measuring in degrees an arc of a circle of unknown dimension and whose center is not located; insures accuracy in arc and angle measurements; measures line segments and radii and expresses their length in a certain exponent; finds the limits of each successive arc and center of its respective circle in any curve, so that any curve may be inked with a



DRAWING INSTRUMENT.

compass; analyses any curve into measured arcs and radii for a complete record; uses such record for reproducing segments of curves or symmetrical curves of the same on enlarged or reduced scale; builds complex and compound curves and figures of straight lines and curves; forms designs composed of similar curves of varying sizes; expresses the exponents of the algebraic expression (abⁿ); and performs other measurements. The engraving shows a face view of the instrument.

NUT LOCK.—B. G. PARTRIDGE, 2126 W. 14th St., Oklahoma, Okla. In this invention a dog or locking device is arranged in a slot or recess in the nut and adapted when in a certain position to engage the thread of the bolt, and when in a reverse or opposite position, is out of engagement therewith. Fig. 1 shows an enlarged sectional view representing a nut and bolt and locking device applied as in use. Fig. 2 is a cross section of a bolt and nut showing the dog or locking device in a non-locking position. Figs. 3, 4 and 5 show

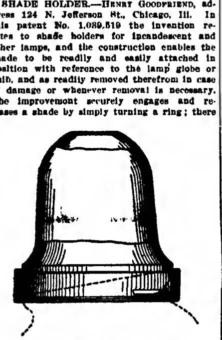


NUT-LOCK.

diagrammatically the different positions of the locking device which is in the form of a scalene triangle, one corner of the base being acute-angled and the other right-angled, and its biting edge is adapted to conform to the thread of the bolt. The bottom of the slot is formed to describe an obtuse angle, the apex of the angle constituting a fulcrum for the dog on which the latter is adapted to rock in assuming different positions. On one side the slot is much deeper than the other, and the inner acute angle of the dog enters this part when the dog is engaged with the thread.

Heating and Lighting.

SHADE HOLDER.—HENRY GOODFRIEND, address 124 N. Jefferson St., Chicago, Ill. In this patent No. 1,039,519 the invention relates to shade holders for incandescent and other lamps, and the construction enables the shade to be readily and easily attached in position with reference to the lamp globe or bulb, and as readily removed therefrom in case of damage or whenever removal is necessary. The improvement securely engages and releases a shade by simply turning a ring; there

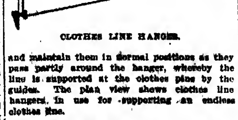


SHADE HOLDER FOR INCANDESCENT AND OTHER LAMPS.

are no springs, wires, clamps, screws or any parts that can get out of order; it does away with the unsightly appearance of screws which are often lost in handling; it prevents breakage of glass by allowing for expansion by heat; it can be stamped out of sheet metal at small cost in any size and shape and in a large variety of designs; and it may be used on gas as well as on electric fixtures in upright or in vertical position. A side elevation of the shade-holder partly in section is shown herewith.

Household Utilities.

CLOTHES LINE HANGER.—L. KALMANOVITS, 639 Tinton Ave., Bronx, N. Y., N. Y. This device comprises a pair of spaced plates, a roller journaled between the same and adapted to have a line pass around it, and a guide movably mounted relative to the plates, and adapted to engage clothes pins or other projections or objects on the line, and to guide



CLOTHES LINE HANGER.

and maintain them in normal positions as they pass partly around the hanger, whereby the line is supported at the clothes pins by the guides. The plan view shows clothes line hangers in use for supporting an endless clothes line.

Machines and Mechanical Devices.

RIFLE TRYING DEVICE.—J. LIVTSCHAK, St. Petersburg, Russia. The invention relates to improvements in this inventor's former device, whereby the present device is simplified. The rifle is permitted to move in the direction of the recoil, after which it can be returned by hand to the initial position. The fire arm is held truly square in initial position by providing on the front supports two parts, of which one above the barrel and gunstock is provided with a notch for the bed of backsight on the barrel and the other part beneath the rifle guides a clamping ring on the rifle.

MULTIPLE LOOM.—G. GRATREAU, Paris, France. This invention relates to five improvements in multiple looms, whereby numerous drawbacks in other looms are avoided, so that the simultaneous weaving of two or several pieces of fabric is rendered easy and safe, while the examination of the lower pieces of fabric during the work is rendered possible.

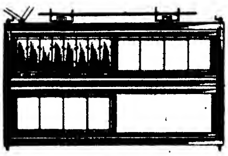
MACHINE FOR CASTING AND COMPOSING TYPE.—F. SCHIMMEL, 103 Rue du Sergent Blandan, Nancy, Meurthe et Moselle, France. This invention refers to an arrangement of matrices for casting and composing separate types, adapted to be applied to all kinds of machines for casting and composing type one by one, and adapted to permit a mixed composition of type of different fonts or characters, requiring, as in linotype machines, a large number of matrices for each font or character.

BENDING MACHINE.—F. T. ROOT, care of Defiance Machine Works, York, Pa. The object here is to provide a machine arranged to automatically impart a gradual traveling motion to the head blocks during the bending operation to compensate for the increase in length of the timber incident to the bending thereof, thus allowing the timber to hug the form very snugly and thereby insuring the formation of accurately bent timber.

PACKING MACHINE.—G. H. CAUGHRRAN, Ketchikan, Alaska. This device is particularly useful in packing canned goods into cases preparatory to shipment. An object of the inventor is to provide machinery for automatically filling the cases with cans, thereby economizing in time in an operation which is generally performed by hand. The cans are automatically deposited in layers, and the case containing the cans discharged when the case becomes filled.

SIPHON FILTER.—J. A. CASE, Salida, Colo. Mr. Case's improvement is in siphon filters and has for its object the provision of a mechanism especially designed to thoroughly filter liquids, while at the same time facilitating the withdrawal of the liquid from the receptacle.

EMBROIDERY MACHINE.—E. FRIEDMAN, 2838 Fulton St., Brooklyn, N. Y. The invention relates to hand or power embroidery machines having a fabric-carrying frame adapted to be shifted according to the design of a pattern plate for the needles and thread to produce the desired embroidery on a piece of fabric. The machine secures accurate alinement and stretching of fabric material in in-



EMBROIDERY MACHINE.

dividual frames, and exposes only the surface portion of the fabric material to be embroidered, thus permitting the accommodation of a large number of single frames on one machine at a time, thereby increasing the output of the machine. The engraving shows a front elevation of a series of fabric frames mounted on the main frame of the embroidery machine.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Bagdad Railway

(Concluded from page 442.)

by a permanent handsome structure of iron and steel which will occupy three years in erection. The river here is nearly a mile wide in flood time and the current runs very strong.

It is ultimately intended that Alexandretta, near the extreme northeast corner of that part of the Mediterranean, shall be the Syrian port of the Bagdad railroad and a pier has already been constructed here. It is proposed to run the rails from this port to Osmaniyeh on the main line. The merchants at Aleppo, however, are endeavoring to induce the Germans to run the line from Alexandretta direct to Aleppo. The Germans were to have built a harbor at Alexandretta and collected a large quantity of material here for this purpose. They have now suddenly ceased, so far as the harbor is concerned. Locally, different reasons are given. Some declare it is for the want of funds, which is not to be credited, for money is being used almost profusely on the main lines. Others say it is because Great Britain has interfered, which is the more probable. No doubt she objects to the Germans establishing themselves on the Mediterranean, and in any case the harbor bids fair to hang fire until a satisfactory understanding with England is arrived at. Alexandretta, too, is in a marshy locality and suffers from fever, and extensive sanitation is called for to make the place healthy. Just south of Osmaniyeh rise the Amanus mountains and here an army of men have commenced the boring of a six-mile tunnel. The whole of the material in the way of rails, sleepers, stone and iron work for the bridges, lumber for the stations, locomotives and rolling stock is supplied by German manufacturers. This is one of the conditions of the concession and is rigidly enforced by the contractors. Thousands of cars for passengers and freight are now being built in the Fatherland. The passenger cars are to be of the finest kind and include sleeping and dining saloons. All private supplies, too, for the engineers come from Germany. Naturally, the principal engineers are Germans, though thousands of Turks are found among the ranks of the laborers.

Taking the route from Scutari to Aleppo the present gaps do not amount to more than a hundred miles. Yet it is doubtful if a through communication will be possible for another couple of years or more. It all depends upon the success of the engineers in the Taurus Mountains. When the connection is at last made the Bagdad Railroad will at once jump into popular prominence as affording direct railroad communication between Europe and the sacred cities of Palestine as well as with the Euphrates. This will be rendered possible because the Turkish Government has already advanced the lines from Damascus to Aleppo. Then from Damascus, railroad connection may be had with Nazareth and Haifa, and as it is intended to connect Jerusalem with this system the Holy City will also be in railroad touch with Damascus and also with Aleppo in the far north. This will mean that one will be able to journey by rail from the great centers of Europe to Constantinople and then across by ferry to the other side, and on by train to the cities of Palestine. Ultimately, however, it is expected that a bridge will be thrown across the Bosphorous, connecting the Bagdad line with those of Constantinople, thus giving a through communication with the vast railroad systems of Europe.

Indeed, this linking up of Syria and Mesopotamia, with its ancient sacred cities, with Europe by rail, is one of the most interesting features of this great undertaking. Mosul, on the Tigris, is a flourishing little village that has sprung up upon the ruins of ancient Nineveh, and is expected to be reached early in 1914, if not before. From here the railroad will follow the west bank of the Tigris to Bagdad. The stretch of country lying between the rivers Euphrates and Tigris is said to mark the site of the Garden of Eden. This is now to be [illegible]

INQUIRY COLUMN

Inquiry No. 9256. Wanted household novelties or business necessities which can be retailed at from $1 to $5.

Inquiry No. 9257. Wanted to buy a machine which will reduce cobs to meal—not a machine for shredding the cobs, but a machine that will pulverize them.

Inquiry No. 9258. Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9259. Wanted substance melting at 225° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor.

Inquiry No. 9260. [illegible]

and only sparsely inhabited, but in ancient times it was fertile and thickly populated, the seat of an empire that swayed the East. Not far from Bagdad lie the ruins of ancient Babylon, that mighty city reared by Nebuchadnezzar, and it is expected that many will travel over the railroad to visit them. Thus will the Bagdad line bring those old Bible cities of Mesopotamia into close communication with Europe as well as the sacred cities of Palestine. Then, when the Gulf is reached, it is but a hand's throw, as distances go, across Persia to India, and it is surely not too much too expect that the Bagdad enterprise, despite all the anxieties it has caused to European statesmen, will eventually result in the carrying of the steel rails into that Empire.

Some Remarkable Specimens of Ancient Glass

THE remains of an ancient glass works of the Roman period which the French archæologist M. Bauget discovered near St. Menehould showed many specimens of glass and colored enamels, and from these M. Franchet was able to draw some interesting conclusions. He discusses the two general classes of transparent glass and enamels. Many specimens of glass cut into cubes for use as mosaics were found here. As regards the glass, this had about ten different tints, and the colors were obtained mainly with iron oxide for the greens, cobalt oxide for the blues and oxide of manganese for the violet shades. A thin layer of *hematinon* which is a copper red glass is also applied upon clear glass as at the present day. Such glass was used mainly for vessels and bottles, but some very flat glass plates were also found. Most remarkable are the enamels used for mosaics, and in spite of the lack of means which modern industry gives, the Romans were able to produce series of color shades for the enamels which are most varied. M. Franchet recognized thirteen main colors, giving an *ensemble* of ninety-eight tones, and the number certainly did not end here. Such enamels he considers as very fine specimens of industry, and he mentions the series of *hematinon* reds, obtained by reducing copper oxide by means of iron protoxide. The antimony yellow enamels, the turquoises which are the most striking of all and are obtained by copper oxide dissolved in an alkaline silicate, the series of greens obtained by mixing the turquoise blue with antimony yellow, were also remarked. The gradation of tones in the same color series gives a perfect regularity and shows great skill in this art. He considers that the technique of these enamels is clearly of Egyptian origin, and that the products closely resemble those which are found in Egypt belonging to the Saite epoch. But these processes appear to have been known in Persia much farther back. The Gallo-Roman products are enamels in the strict sense of the word, and he made experiments in order to coat them upon pottery of the same period, being successful in doing this. It is therefore a matter of surprise that the Romans who showed such great skill in producing enamels, never used these for decorating pottery.

Return of the Swiss Trans-Greenland Expedition

DR. ALFRED DE QUERVAIN and his party of six, who left Disko Island, on the west coast of Greenland, with 29 dogs and 3 sledges on June 10th, succeeded in crossing the inland ice and arrived at Angmagsalik, on the east coast, August 1st, whence they returned to Copenhagen October 12th. Their route was farther north and longer than that followed by Nansen, who made the only previous crossing of Greenland in 1888, but much shorter than that to be followed by Koch's expedition, which is now marching westward from Cape Bismarck. Dr. de Quervain's party report crossing a vast inland lake, covered with thin ice. Near the east coast they discovered and surveyed a large mountainous district, which they named Switzerland. [illegible]

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12701) W. A. B. asks: It is known that the waters of the ocean contain about three per cent of minerals in solution, about three fourths of which is common salt. Will you please state in your Queries and Answers column what are the percentages of the other minerals held in solution, as far as known? A. The water of the ocean and of salt seas does not have a definite proportion of the various salts in it, nor the same proportion in all parts of the ocean and the seas. For this reason no exact statement of quantities is possible. Indeed, the salts present are not the same for all sea water. The Encyclopedia Britannica gives a table based upon the assumption of 35 parts of solid salts in 1,000 parts of sea water. This table shows:

	Parts.
Sodium chloride	27.213
Magnesium chloride	3.807
Magnesium sulphate	1.658
Calcium sulphate	1.260
Potassium sulphate	0.863
Calcium carbonate	0 123
Magnesium bromide	0.076

(12702) A. H. B. says: My friend and I have had a long discussion upon the question of the exact difference between "art," "science," and "scientific." My friend claims that there is a difference in the meaning of the words "art" and "science." I claim that science is applied art. A. The words "art" and "science" have distinct meanings, and yet relative meanings. The science of navigation comprises the rules and theory by which a ship is directed from one port to another. This a man can learn who has never seen a ship. It is largely mathematical, and is taught in colleges far from the seaboard. The art of navigation consists in actually being able to direct the ship across the waters to its destined port. A man may know the art of navigation with very little knowledge of the science or theory of navigation. Many a captain of a small coasting vessel can work his latitude and longitude with no knowledge whatever of the reasons why he takes certain numbers from the tables and does certain things with the numbers. These illustrations will help to the understanding of the use of these words. An art *implies* the *skill* or ability to do something. The word "art" means "skill." A science is the body of knowledge upon a certain subject; the word "science" means knowledge. Botany is the science of the laws of plant life. Carpentry is an art Ship-building is an art; the principles of ship-building are a science. The word "scientific" means pertaining to science. A scientific man is one who is occupied with a science, or spends his time in work connected with science. Art is applied science, and not, as you say, science is applied art

(12703) N. J. L. asks how to make carbon Rods and Plates A. Carbon rods and plates of the finest quality can be made economically only by the use of expensive machinery and apparatus, such as pulverizing mills, hydraulic presses, and retorts or ovens; but the amateur, without a great deal of trouble, and with very little expense, can make carbon plates and rods which will answer a good purpose. The materials required are wheat, coke, flour, molasses or syrup, and water. The tools consist of a few molds, a trowel or its equivalent, for forcing the carbon mixture into flat molds, tubes to be used as molds for carbon rods, and ramrods for condensing the material in the tubes and forcing it out, and an iron mortar, or some other device, for reducing the coke to powder. Clean pieces of coke should be selected for this purpose, and such as contain no volatile matters are preferred. The coke is pulverized and passed through a fine sieve It is then thoroughly mixed with one sixth to one eighth its bulk of wheat flour, both being in a dry state. The mixture is moistened with water (or water with a small percentage of molasses added) sufficiently to render it thoroughly damp throughout, but not wet It should now be allowed to stand for 2 or 3 hours in a closed vessel, to prevent the evaporation of the water. At the end of this time the mixture may be pressed into molds of any desired form, then removed from the molds, and dried, slowly at first, afterward rapidly, in an ordinary oven, at a high temperature. When the plates or rods thus formed are thoroughly dried they are packed in an iron box, or, if they are small, in a crucible, and completely surrounded by coke dust to exclude air and to prevent the combustion of the plates or rods during the carbonizing process. The box or crucible must be closed by a non-combustible cover, and placed in a furnace or forge fire in such a way as to cause it to be heated gradually to a red heat. After the box becomes heated to the required degree, it is maintained at that temperature for an hour or so, after which it is removed from the fire and allowed to cool before being opened. The rods or plates are then boiled for half an hour in the syrup, or in molasses diluted with a little water. They are again baked in an ordinary [illegible]

bing is repeated until the required density is secured. As some gases are given off during carbonization, it is necessary to leave the box or crucible unsealed to allow these gases to escape.

(12704) R. C. W. asks how to work and treat meerschaum pipes.—1. Meerschaum is worked in the following way: The large pieces of meerschaum are cut with a band saw to a convenient size, after which the material is soaked in water until it becomes quite soft. When wet it becomes very soapy, and will produce quite a lather if rubbed. After being thoroughly soaked, the meerschaum can be cut like cheese, and it is then roughly shaped with a knife to the form of a pipe. When dry, the bowl and stem shanks are drilled, and then if the pipe is of a plain pattern, it is turned on a lathe to the desired form. If a square stem shank is desired, it is shaped with a file. The shank is now shouldered and threaded to receive the amber stem piece. 2. Cleaning.—A very simple and effective way of cleaning the inside of a pipe is to plug up the bowl with a cork in which a hole has been bored. Fit the cork against the water tap and turn on the water. To clean the outside of the pipe, make a thick paste of whiting and turpentine, and brush it over with a hard brush. Leave the paste pretty thick on the pipe and allow it to become quite dry, when it should be brushed off with a clean hard brush. Finish cleaning the pipe by rubbing over with a soft cloth and sweet oil. 3 Discoloration, Removing.—To clean the carving on a meerschaum pipe and remove the black around the top, wash the bowl with hot milk, using a tooth or nail brush to clean the dirt out of the carved portion For the black part try the effect of very fine pumice powder and benzoline; bring up the gloss again with putty powder and a trace of olive oil The greater part of the coloring of a meerschaum may be removed by steeping it for some time in moderately strong ammonia solution, 1 part of strong ammonia to 2 parts of water. 4. Imitation.—These are said to be prepared from a mixture of the artificially prepared silicates of magnesia, alumina, and lime, and sulphate of lime, these are mixed together in the state of pastes, dried at the ordinary temperature, cut into small blocks, and dried on a stove. The blocks are then turned in the lathe in a similar manner to real meerschaum. Imitation meerschaum pipes should not be varnished; the varnish will burn or crack when the pipes are smoked They may be warmed and rubbed with a little white wax and then polished with a soft rag The best way, however, is to polish them with a revolving wooden polishing wheel covered with leather or felt, using dry putty powder or whiting.

(12705) R. L. N. asks how to clean and prepare bones and ivory. A. 1. The curators of the anatomical museum of the Jardin des Plantes have found that the spirits of turpentine is very efficacious in removing the disagreeable odor and fatty emanations of bones or ivory, while it leaves them beautifully bleached. The articles should be exposed in the fluid for 3 or 4 days in the sun, or a little longer if in the shade. They should rest upon strips of zinc, so as to be a fraction of an inch above the bottom of the glass vessel employed. The turpentine acts as an oxidizing agent, and the product of the combustion is an acid liquor, which sinks to the bottom, and strongly attacks the ivory if allowed to touch it 2. Make a thick paste of common whiting in a saucer Brush well with a toothbrush into the carved work. Brush well out with plenty of clean water. Dry gently near the fire. Finish with a clean, dry, hard brush, adding one or two drops (not more) of alcohol. 3. Mix about a tablespoonful of oxalic acid in ½ pint of boiling water. Wet the ivory over first with water, then with a toothbrush apply the acid, doing one side at a time, and rinsing, and finally drying it in a cloth before the fire, but not too close.

(12706) T. M. N. asks for rosin for bows, violin. A. 1. For violin rosin, boil down Venice turpentine with a little water until a drop, cooled on a piece of glass, is of proper consistency During the boiling, cold water must be added from time to time. When sufficiently thick, pour into cold water, knead well, and when cold break into pieces. Expose to sun until dry and transparent. 2. Select the best clear brown rosin, melt it in a clean basin, to merely a boil, which will clear it of turpentine or other volatile oils. Pour in paper molds.

(12707) J. C. asks: Some scientists claim that the universe began as a cold, nebular vapor, and acquired heat by contraction. How could the elements, as we know them, exist as vapor in the cold, since they are all vaporized by sufficient heat and solidified by cold? It is not more reasonable to suppose that the universe began in a state of intense heat and is now cooling off; or would the fact that space itself is intensely cold favor the cold nebula idea? What is the probable temperature outside our atmosphere? Can you advise some books that will give information on this subject? A. There are two hypothesis in reference to the condition of the matter of the universe at the moment when science begins its discussion of the formation of the worlds. Both these agree that the matter was in a nebulous condition. As Prof. Young says, "This does not assume that matter was created in a nebulous condition. As the egg may be taken as the starting point for the life history of the animal, so the nebula may be taken as the starting point for the life history of the planetary system." On one theory the nebula was in the form of a heated gas; on the other, it was a cloud of cold meteoric dust. This latter many astronomers think is more likely to be true. The probable temperature of outside space is at or very near absolute zero. A recent discussion of this subject is to be found in Young's "Manual of Astronomy," price $2.25; or in Moulton's "Introduction to Astronomy," price $1.60.

NEW BOOKS, ETC.

Fire Prevention. By Edward F. Croker, ex-chief of the Fire Department of New York city. New York: Dodd, Mead & Co., 1912. 8vo.; 354 pp.; illustrated. Price, 1.50 net.

In the United States, in the year 1907, building operations were carried on to the value of \$1,000,000,000. In the same year the fire loss on buildings was \$456,000,000. Thus nearly half as much property value was destroyed by fire as was created by the capital and industry of the nation. This constitutes a serious arraignment of our national habits, and it is high time that attention should be called to the necessity for greater and more intelligent precaution in home and business life. It would be hard to find a man better qualified to speak from the depths of knowledge and experience than Edward F. Croker, who was for twelve years chief of the most efficient fire department in the world. He begins at the beginning, with the individual and the home, the greater number of fires and a large percentage of the fire loss are chargable to the dwelling house. The author declares that out of twelve million buildings, probably eleven millions have been built "in entire disregard of the combustible nature of their materials." The shingle roof is particularly condemned as dangerous, and the false economy of such methods is pointed out. Among other precautions urged is the use of fire-retardant paints and whitewash. Dwelling-house equipment for the extinguishment of fires is thoroughly considered. Larger structures, for storage, manufacture, etc., next receive attention, and here again the matters of construction and equipment are clearly placed before the reader. Most interesting and instructive are the chapters on the fire department of the large city The nature and the value of high-pressure water service, the modern fire-boat, and the law-making side of the problem each are dealt with in separate chapters. It is to be hoped that so authoritative a work may receive the attention it deserves, and that we may awaken to the criminal carelessness which alone makes possible so appalling a record.

The Railway Library. 1911. (Third Series.) Compiled and edited by Slason Thompson. Chicago: Bureau of Railway News and Statistics. 8vo.; 468 pp. Price, 50 cents.

Following the custom of past years, "The Railway Library" for 1911 is a collection of papers presenting various phases of the problem of transportation, these addresses and papers having been for the most part delivered or published during the year These are by no means confined to bringing out points favorable to the roads, but deal impartially and from varying points of view with such subjects as the Interstate Commerce Commission, railway securities, Government ownership, efficiency of service, arbitration of disputes, the railway mail service, and French and British roads. A large portion of the work is devoted to statistics of American railways The author is Director of the Bureau of Railway News and Statistics, and has succeeded in putting out a volume of the greatest interest to the student of railway conditions and problems

The Sherman Anti-trust Act and the Patent Law. The Supreme Court on Patents (the Dick Patent Case). By Gilbert H. Montague of the Bar of New York City. (Reprinted from the Yale *Law Journal*, April and May, 1912.) New Haven, Conn.: Press of S. Z. Field, 1912.

So much misinformation has been spread abroad on the subject of patent monopolies, that Mr. Montague has performed a useful service in here presenting the very vital difference between the monopolies which fall under the Sherman Anti-Trust Act and the monopolies that are granted to patentees of inventions. It is not generally realized that the Sherman Act is based upon an implication from that indefinite provision of the Constitution which authorized Congress "to regulate commerce with foreign nations and among the Federal States." Nor is it recognised that under the Constitution patentees are expressly given the exclusive right to their inventions within prescribed limits. The monopoly contemplated in the Sherman Anti-Trust Act may deprive the public of many privileges that it once enjoyed. the monopoly created by a patent takes nothing away from the public, but on the other hand gives it something that it never had before

Mr. Montague takes up the subject of patents and trusts from the standpoint of the following three propositions·

First· The fact that the owner of a patent is a combination or a party to a combination, formed or existing for the purpose of monopolising patents of the same general character, will not avail an infringer of such patent, who is not a licensee or party to such combination, as a defense to a suit for infringement, brought by the owner of such patent. Similarly, the fact that the owner of a patent is a combination or a party to a combination, formed or existing in violation of the Sherman Act, will not avail an infringer of such patent, who is not a licensee or party to such combination, as a defense to a suit for infringement brought by the owner of such patent.

Second: The owner of a patent may impose restrictions upon the use of the patent and the manufacture and sale of the patented articles by the licensee, and such restrictions, if part of that express agreement between the owner and such licensee, may be enforced by the owner against such licensee.

Third: The owner of a patent [illegible] restrictions upon the use and [illegible]

article by the party to whom such article is sold, and such restrictions, if made known to such party, may be enforced against such party by the owner of the patent, even though no express agreement exists between them.

Mr. Montague shows that the first proposition of law seems well settled. The third proposition upon the present state of the authorities is also well established. The only modification seriously urged in respect to it would at most merely save from contributory infringement suits, parties who furnish general articles of commerce to the users of patented articles Whatever bearing this possible modification may have on the third proposition, it appears upon analysis to throw little light on the relation of the Sherman Anti-Trust Act to the patent law. The second proposition of law upon the present state of the authorities is also well established But in respect to this second proposition, and also the third proposition, the contention has been advanced in some quarters that the Sherman Anti-Trust Act forbids the owner of a patent to agree with another to restrain his own use of the patent and the manufacture and sale of the patented article.

Mr. Montague points out what we have ourselves dwelt upon editorially in the SCIENTIFIC AMERICAN, namely, that the Constitution provides that Congress shall have power "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." This constitutional guarantee of an exclusive privilege to the patentee flatly contradicts the prohibition of the Sherman Act, as Mr Montague well insists. There is no reconciling the two. They are mutually inconsistent. One must yield to the other. Accordingly, it cannot be assumed that the Sherman Act intended to interfere with rights established by the Constitution and granted by the patent law

RESEARCHES ON CELLULOSE. III. (1905-1910.) By C. F. Cross and E. J. Bevan New York: Longmans, & Co., 1912. 8-vo.; 173 pp. Price, $2.50 net.

This is the third volume of a series issued by Cross and Beven, the first covering the years 1895-1900, and the second 1900-1905. Since the publication of the second volume, additional technical institutions devoted wholly or mainly to this branch of chemical research have been organized For example, England has a recently-founded Textile Institute devoting itself in large measure to this branch of industry. While in Germany, in 1905, a society calling itself "Verein der Papier & Zellstoff Chemiker" was started, and this has developed into an influential body that formulates problems for solution, and stimulates work upon these problems by a system of prizes The published records of this society are very full, and the reader is referred to them for much information. The colloidal state introduces unusual complications, and calls for an accuracy in experiment that shall be little short of perfection The constitution of cellulose is the subject of an early chapter, and the behavior of esters and autoxidation of ligno-celluloses are set forth in most interesting observations Practical investigators will perhaps turn most eagerly to the chronicle of technical developments in Chapter V, where the most significant steps of recent progress receive discriminating attention

PIGMIES AND PAPUANS. The Stone Age To-day in Dutch New Guinea. By A. F. R. Wollaston, with Appendices by W. R. Ogilvie-Grant, A. C. Haddon, F.R.S., and Sidney H. Ray. New York Sturgis & Walton Company, 1912 8vo.; 352 pp.; with illustrations and maps Price, $4 net.

Mr. Wollaston's work is a circumstantial account of the expedition of the British Ornithologists' Union, the Royal Geographical Society also being represented This expedition to the Snow Mountains encountered even more than the usual physical difficulties of an unexplored region, and, while it failed to penetrate these ranges to a greater height than some 4,000 feet yet collections of great importance were made, and distinct contributions to science accomplished The natives of New Guinea are most intimately described, with their arms, characteristics, and manner of living. These descriptions are augmented in interest and value by splendid illustrations in monochrome and in colors. Savage skill with the bow and arrow is somewhat discounted by the observations of the expedition, two Papuans failing to hit an iguana at twenty feet, although arrow after arrow was launched at the bulky creature. The Pigmies, or "Tapiro" were occasionally encountered, and at last were with much difficulty persuaded to escort the party to one of their villages. The Pigmies and the Papuans seem to be on terms of the utmost cordiality. The average height of forty adult males was found to be 4 feet 9 inches. In spite of all inducements, the women of the village were not produced, but were held secluded until the departure of the visitors.

SEASONAL TRADES. By Various Writers. With an Introduction by Sidney Webb. Edited by Sidney Webb, LL.B., and Arnold Freeman, M.A. London: Constable & Co., Ltd., 1912. 8vo.; 410 pp. Price, $3 net.

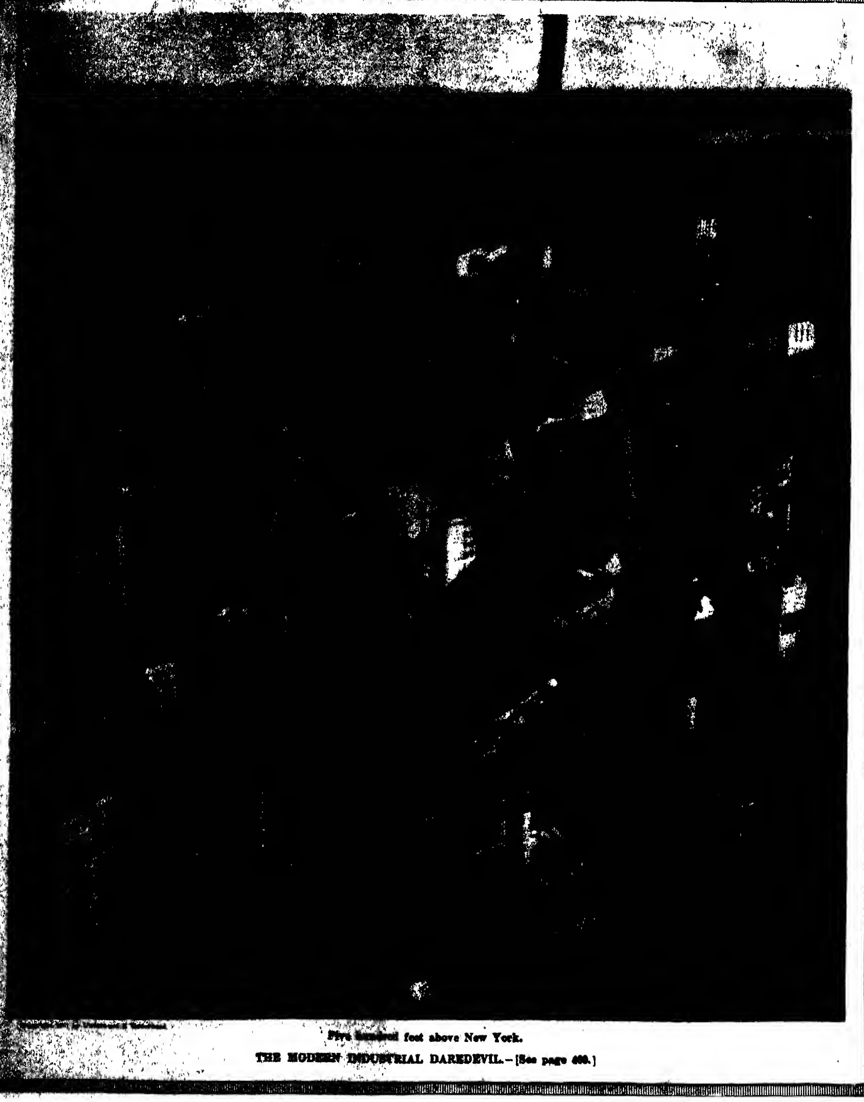
Included among the trades studied are the cycle industry, the gas industry, the London millinery trade, the building trade, the shoe trade, and the occupations of the tailor and the waiter. The investigations show long, patient and original work, and the volume is a welcome contribution to practical economics that, in England at least, should become a book of standard reference among those seeking to ameliorate the conditions of industrial life.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 22] NEW YORK, NOVEMBER 30, 1912 [PRICE 10 CENTS $3.00 A YEAR



Five hundred feet above New York.

THE MODERN INDUSTRIAL DAREDEVIL.—[See page 460.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 30, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries one year, postage prepaid,	4.50
Subscriptions for Canada one year, postage prepaid, ...	3 75

The Scientific American Publications

Scientific American (established 1845)	per year,	$3 00
Scientific American Supplement (established 1876)	"	5.00
American Homes and Gardens	"	3.00

The combined subscription rates and rates to foreign countries including Canada will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Every Man to His Trade

AMONG the various collateral activities of the Navy Department, there is none in which greater efficiency has been shown than in the work of the Hydrographic Office. A most important publication of the office, which has won world-wide recognition, is the *Pilot Chart*—to be found in the chart house of every kind of ship that crosses the Atlantic, where it is recognized as one of the most effective safeguards of transatlantic travel.

The Hydrographic Office at present collects information as to dangers to navigation, treacherous derelicts, wrecks, drifting buoys, icebergs, and other matters of vital interest and importance to the mariner. Daily memoranda are issued, giving the positions of all dangers, and this is supplemented by a weekly bulletin containing this information in detail. The *Pilot Chart*, published at the end of each month, is not only a compendium of all this information, but it contains special articles by skilled officers that afford a fund of information totally inaccessible except through such a long-established and carefully-organized system as characterizes the Hydrographic service. The work of the Hydrographic Office has recently grown to be of such importance to mariners all over the world, that the maritime officials of the European nations have arranged for co-operation for the benefit of all mariners. The agency of wireless information has made the New York branch a sort of clearing house for this information. The system of collection and distribution of news is the most perfect that has ever been devised in the interests of the navigator. The Hydrographic Office receives wireless notice from ships at sea of dangers to navigation, and as promptly disseminates this by telephone, telegraph and wireless. It is the custom for commanders of ships on the day before going to sea, or on the day of sailing, to visit the various branch offices in search of the latest news in respect to dangers to navigation. In the case of several lines, this is done under a positive order from their head offices.

Furthermore, arrangements are being perfected whereby, as soon as notification of any danger on the transatlantic route is received, the news will be transmitted by cable to the Hydrographic Offices in Europe, to be there given to the various shore stations for further transmission to shipping which is about to depart or has departed for this side of the Atlantic. The *Deutsche Seewarte* of Germany thought enough of the American Hydrographic Office to request them to act as the headquarters for this service, this office being considered the one bureau best qualified to carry it out. It is a cause for gratification to know in what high esteem the office is held both here and in Europe. The *Pilot Chart* is accepted as accurate, principally because it is prepared by nautical men for nautical men. Thus a British marine officer in the *Atlantic Monthly* of July, 1909, writes: "Sailing ship captains owe many a smart passage to the wind and current charts supplied to them. As far as practical benefit to sea-faring is concerned, the American Hydrographic Office is far and away ahead of that of any other nation and is blessed by navigators of nearly every country under the sun."

In view of these facts, the SCIENTIFIC AMERICAN regrets to learn that a strong effort is again being made by the Weather Bureau of the Department of Agriculture to obtain control of the appropriation for the publication of the *Pilot Charts*. Furthermore, the Weather Bureau staff wish, forsooth, to prepare and publish these charts themselves. So far as our investigation has gone, the proposed change is strongly opposed by those very interests—the shipping companies and the captains of steamships and sailing vessels—for whose guidance the charts are issued. They claim—very properly, as it seems to us—that the compilation of such a purely nautical document should be done by nautical men possessed of the technical training and practical sea-faring experience which are the necessary qualifications for special work of this character.

Washington is prolific in boards of investigation, and this matter of the *Pilot Charts* was made the subject of one of these so recently as March, 1911, when a board composed of Gen. Crozier, Chief of Ordnance, U. S. A.; Mr. Ross, Director of the Bureau of Engraving and Printing; and Mr. Putnam, Commissioner of Lighthouses, reported, after careful consideration, in favor of retaining the publication of the *Pilot Charts* in the Hydrographic Office.

Far be it from us to say anything derogatory of the work of the Weather Bureau. It is constantly enlarging the sphere of its operations, and its work is well done; but in proposing to take over from the Navy Department a purely naval publication, the Bureau is showing something of that "vaulting ambition which o'erleaps itself." The Agricultural Department has its hands full in looking after its duties ashore; let it leave nautical matters to those who are technically qualified—particularly where they are as well administered as in this matter of the *Pilot Charts*.

Every man to his trade. If the Weather Bureau has suddenly discovered in itself some hitherto unsuspected qualifications for purely nautical work, why should it stop at the *Pilot Charts*? Why should it not assume the work of compiling the *Nautical Almanac*, now so ably—at least so we have fondly believed—done by the Naval Observatory? And this suggests astronomy. There may be some subtle relation between the Moon, the Milky Way and the crops; so why not make a clean sweep of it and place the Weather Bureau man at the eyepiece of the telescopes at Mount Wilson Observatory?

The "Bath-tub" Decision and the Patent Law

IN its way the decision of the United States Supreme Court against the "Bath-tub Trust" is far more important than that handed down in the "Rotary Mimeograph Case," for it not only upholds the Sherman Anti-Trust Act, but also clearly limits the use which may be made of a patent to control an entire industry. Yet, the decision is not revolutionary. None of the time-honored privileges of the patentee—among them the right to fix prices and to dictate the manner in which a machine may be used—is curtailed. Nor can the Sherman Anti-Trust Act be evaded by combinations of manufacturers, who disguise themselves as licensees under a patent.

The full significance of the "Bath tub" decision can be truly appreciated if we contrast it with the Rotary Mimeograph case. The A. B. Dick Company, owners of the mimeograph patent, sold their product with the license restriction that it be used only in connection with ink, stationery and other supplies bought from the patentee. Beyond that there was no attempt to control the industry of manufacturing duplicating machines, either by the A. B. Dick Company or its licensees. The situation in the bath-tub case was quite different. The various manufacturers that constituted the Trust agreed under license restrictions to manufacture bath-tubs and other enameled ware with patented machinery, and to sell their products at a fixed price. Had that price been determined by the owner of the patents, as in the rotary mimeograph case, and had there been no combination of licensees the decision of the Supreme Court would have been quite different. In the rotary mimeograph case each licensee was absolutely independent of every other licensee under the Dick patents. In the bath-tub case the licensees formed a combination, subjected themselves to rules and regulations, among others not to sell their product to jobbers except at a price fixed, not by the trade and competitive conditions, not by the owner of the patents alone, but by a committee of six of their number. Jobbers were brought into the combination; for unless they entered they could obtain no enameled ware from any manufacturer-licensee. Is it any wonder that the Supreme Court held that the owners of patents cannot employ them to legalize a trust or agreement which violates the provisions of the Sherman law?

The decision does not in the slightest degree take from the owner of a patent any part of the exclusive rights secured to him under the Constitution and under our patent laws. It holds simply that the owner of a patent is not in any better position to form a trust than any other human being. His patent is not a magic cloak that protects him from judicial scrutiny. He has the right to control the manufacture, use and sale of his patented inventions; he can dictate the terms and conditions upon which he grants to others the right to use his patented machines, even to the extent of compelling the user to purchase from him certain patented supplies needed for use with the machine at such price as he may choose; he can fix the [illegible] price of patented articles when sold by dealers at retail. But farther than that he cannot go. The licensees must be independent. He cannot arrange them into a combination and permit them by agreement among themselves to fix the price at which the patented article may be sold.

Technical Questions and the Coroner

CORONERS' investigations of such disasters as the recent wreck at Westport have too often betrayed evidence of being affected by the popular prejudice against the railroads. This is always deplorable. Moreover, the discovery of the causes of such wrecks involves technical questions with which more often than not the coroner is unfamiliar; and hence, in weighing the conflicting testimony, he is at a serious disadvantage.

We commend to the attention of coroners throughout the country the course followed by the coroner who investigated the Westport disaster. To get an intelligent grasp of the problem, and safeguard himself against unconscious partiality, he journeyed far afield, personally inspected crossover conditions on several leading railroads, and consulted living authorities on physics as to the correctness of the theories which had been advanced as to the physical causes of the wreck. Being thus furnished for his task, it is not surprising that the coroner's report is comprehensive, without bias, and distinguished by an unusual grasp of the technical questions involved. The loss of life, he finds, was "caused by the criminal negligence of the engineer . . . and by the concurring negligence of the New Haven Company in allowing its passenger trains to use, at that place, a No. 10 crossover adapted for a safe train speed of 15 to 25 miles per hour only, instead of a No. 20 or other crossover adapted for a safe train speed of 35 to 55 miles per hour."

The course followed by the coroner in making a private personal study of the technical aspects of the question is so commendable, that we quote his statement in full: "In order that no injustice be done the New Haven Company by the above statement" (criticism of track conditions by a former employee of the railroad), "I personally visited various track points along the lines of many of the leading railroads . . . for the purpose of investigating track conditions and to become informed by competent authority as to the probable influence of such road-bed conditions as existed at Westport in causing derailment at that place." During his travels the coroner found that on the Pennsylvania railroad 90 per cent of the crossovers in use on its main lines for its high-speed traffic are of the No 20 type.

From the Engineer of Maintenance of Way and the Assistant Chief Draughtsman of the New Haven Road the coroner elicited the statement that speeds of 45 and 47 miles an hour (the speed of the derailed train as testified to by witnesses) would be practicable on a No. 20 crossover, and he adds, "In addition to the above, practical railroad men of much experience, together with authorities on physics, have advised and convinced me of the feasibility of safely traveling over a No. 20 crossover at an increased speed above that testified to by the witnesses above quoted."

We believe that the impartial attitude of the coroner reflects the spirit of the thinking public. Certainly it is the attitude of the SCIENTIFIC AMERICAN. Although the wreck at Westport could have been avoided by the reconstruction of the crossover, it is not fair to assume or assert, as has been done so freely, that the recent accidents which have occurred on the New Haven Road since the Westport wreck have been due to the poor condition of the tracks. After making a personal examination at the scene of the recent derailment at Green's Farms, we do not hesitate to express our opinion that the accident was due, not as the daily press states, to "rotten ties and poor tracks," but to a minor mishap which might happen on any first-class railroad. The cars left the track at the trailing switch of a short crossover, it is true; but the train did not use the crossover, and the accident was due to a loose equalizer bar of the brake gear, which seems to have displaced the switch, derailing the rear half of the train. The ties at the scene of the wreck are stamped with the date of laying. A few were laid in 1908; some in 1910; and the majority in 1911 and 1912. There are tie-plates on every tie, and a substitution of screw spikes for the old track spikes was in course of being made. The track was in good shape.

Now here was a derailment of a character totally different from that which happened a few weeks before at Westport. In all probability the fall of the equalizer bar is chargeable to poor car inspection; and, if so, the responsibility for the derailment lies at the door of an employee. In the matter of accountability the derailment differs from that at Westport, which, according to the coroner's finding, is chargeable both to the employee and to the company.

Electricity

Automatic Telephones in New Zealand.—After studying the telephone systems of America and Europe the chief electrician of the Post and Telegraph Department of New Zealand has recommended that a full automatic telephone system be installed in Auckland, Wellington, Christchurch, and Dunedin.

German Gasoline-electric Car.—One of the light railway lines in Germany in the region of Königsberg, is making use of a new type of gasoline-electric car which is designed by a prominent Berlin electrical firm. It is fitted with a 4-cylinder 120 horse-power gasoline engine which is coupled direct to a dynamo giving 300 volts and 250 amperes. Current from the dynamo runs by way of a controller into two 85 horse-power electric motors which operate on the driving wheels through a speed reduction gearing of 4.3 to 1. The present car takes 100 passengers and weighs about 60 tons when fully loaded.

Hydro-electric Station for the Swiss State Railroad.—In connection with the extensive electric traction project which is on foot in Switzerland for equipping the State railroad lines, it is proposed to build a number of electric stations in order to make use of water power such as can be obtained from the Rhine, Adige, Rhone and Reuss rivers. Three of the proposed electric plants are to cost no less than $4,000,000 each, according to estimates, and the total expense in this direction will be $14,000,000. In this way a large amount of power such as is needed for operating the lines of electric railroad will be secured in various districts.

Tungsten Lamps or Fraud?—The engineer of a factory at Duisburg, Germany, was recently hailed to court on the charge of having tampered with his electric meter. The evidence against him was that his bill for current for the year was but 188 marks, as against the 587 marks for the preceding year. The accused engineer explained that he had substituted metal filament lamps for the carbon lamps and that this had resulted in the saving of 68 per cent. As there was no other evidence against him but that of the bill, the court decided the case in favor of the defendant.

Volta's Electrical Apparatus Discovered.—In a little old curiosity shop in a back street of a small Italian town Sir Henry Norman, M.P., recently came across a collection of electrical apparatus constructed by Volta, the Italian pioneer in electrical experiments. According to the *London Times*, which reports the discovery, the uncle of the grandfather of the present owner of the collection was Volta's cook and body servant for thirty years. On the death of the scientist, he left much of his experimental apparatus with his body servant and they have since passed down from generation to generation. The collection comprises a cupboard full of old apparatus, a number of books, portraits, papers and letters and some personal and domestic articles. Sir Henry Norman suggests that the collection be purchased and presented to the Royal Institution to remain alongside Faraday's original apparatus.

Pensions for Telephone Employees.—The Bell Telephone system has arranged for a fund of ten million dollars to provide pensions, sick benefits, and life insurance for its 175,000 employees. Men over sixty years of age and twenty years in service will retire on a pension, and the company has the option of retiring them at the age of fifty-five. The pension age for women is fifty-five years with the option of retiring them at the age of fifty. The pension will amount to one per cent of the average annual pay for ten years, multiplied by the years of service, and no pension will be less than twenty dollars per month. An employee who is totally disabled by accident will receive full pay for thirteen weeks, and half pay until he returns to work up to six years. Sick employees receive thirteen weeks' full pay and half pay for thirty-nine weeks. In case of death in the performance of work, the heirs will receive insurance equal to three years' pay with a maximum payment of $5,000. Death from other causes brings insurance in accordance with the years of employment, with a maximum payment of $2,000.

Electric Baggage Trucks.—The use of the baggage truck hauled or pushed by human muscle is being relegated to the limbo of out-of-date by certain progressive railroad and steamship companies. The new idea is a low-deck, heavily built, four-wheel, storage battery driven platform truck which moves the trunks and bags of travelers in a quantity and at a rate of speed which consists with the modern transportation of the passengers themselves. One truck of the new type, operated by the baggage man standing on a small platform at the end, has a rated capacity of 4,000 pounds and is geared for three speeds, the maximum being eight miles per hour empty and six miles per hour loaded. These little giants of transportation are finding favor also in mail handling and in commercial warehouse work. The efficiency in handling mail bags, for example, is shown by the fact that an electric truck can make five trips with a load of two tons in the time required for a hand truck to make four trips with a one-ton load; in other terms, a single electric truck does the work of two and one half hand trucks.

Science

Waterproofing Blocks of Wood.—A good way to harden small blocks of wood used in the laboratory is to boil them in olive oil for about five to ten minutes. Not only are the blocks hardened, but they may be used under water as the process makes them waterproof to a great degree. If desired to be used for collecting gases, that is for supporting bell jars under water, they may be made further waterproof by first boiling them in paraffine, then in olive oil. This makes a wooden block hard and waterproof and every way well adapted for use in pneumatic troughs.

An Arctic Thunderstorm.—A Russian mining engineer describes in *Meteorologische Zeitschrift* a severe thunderstorm far within the Arctic circle. It occurred in Spitzbergen, where the writer was making explorations, on the 13th of last August. The storm lasted about eight hours, with incessant lightning, loud thunder, and heavy rain. Contrary to the prevailing belief, thunderstorms are by no means rare in the polar regions, though they are less common there than in lower latitudes. The storm in question, however, appears to have been altogether exceptional in violence and duration for that part of the world.

Crockerland Expedition.—Plans for the exploration of Crockerland have been so far developed by the American Museum of Natural History and the American Geographical Society that it is possible to announce the starting of the expedition from Sydney, Nova Scotia, on July 20th, 1913, under the leadership of Donald B. MacMillan, who was a member of the last polar expedition under Admiral Robert E. Peary. Besides exploring Crockerland the expedition will also make scientific observations along the northwestern coast of Grantland and the western coast of Axel Heidberg Land, its work being closely connected with that of the other expeditions that have been sent out by the Museum of Natural History and the Geographical Society to clear up the problems of those particular regions.

Rubber Plant Oil for Japanese Umbrellas.—The vegetable oil used in making paper umbrellas in Japan is pressed out of the seeds of the rubber plant. This oil is made in the various islands famous for oil and seeds from these plants. Sandy ground is favored for the cultivation of the plant and the oil is extracted from the seeds by presses. The yield of seeds is estimated at twenty bushels per acre. The annual production throughout Japan amounts to 350,000 bushels, from which over a gallon of oil per bushel is extracted. The oil before it is used is boiled and then cooled until it can be applied by hand to umbrellas with a piece of cloth or waste. No machinery or tools are used in applying the oil. When the oiling is completed the umbrellas are exposed in the sun for about five hours. This oil is also used in making the Japanese lanterns, artificial leather, printing ink, lacquer, varnishes, oil paper, and paints.

The Yearly Variation of Atmospheric Electricity.—It is well known that the electrical potential of the atmosphere reaches its maximum in winter, in our latitudes. The elaborate observations of potential made during Dr. Charcot's last antarctic expedition showed that at Port Charcot (65 degrees 4 minutes south) the average potential was 20 volts per meter during the southern winter, and 68 volts per meter during the southern summer. A writer in the *Meteorologische Zeitschrift* finds that these general results agree with observations elsewhere in the southern hemisphere. It appears, therefore, that the electrical field of the earth is stronger at the time of perihelion than at aphelion. Thus its fluctuation seems to be controlled by cosmical agencies and not by the terrestrial seasons. This conclusion agrees with current views concerning the emission of electrical waves from the sun.

Barnard's Observations of Gale's Comet a 1912.—Prof. Barnard of Yerkes Observatory made a series of photographs of Gale's Comet *a* 1912, with the Bruce 10-inch and 6-inch lenses. His observations are reported in the November, 1912, number of *Popular Astronomy*. The photographs showed a slender faint tail, whose maximum length was about seven degrees. There was very little change from night to night in the appearance of the tail. But on October 14th the tail was bifurcated at a distance of one half a degree from the head. "One rather remarkable feature about the comet," says Prof. Barnard, "was the persistence of a second very short tail at a very large angle to the main tail, on the south side of the head." The angle changed, becoming greater in each succeeding photograph, until in the last negative it was nearly at right angles to the main tail. Prof. Barnard intends to measure this angle carefully for a study of its changes. "It would seem improbable that the comet's tail had any rotation because this short tail remains persistently on one side of the comet throughout the observations." For a few days a very thin streamer about one half a degree long on the north side appeared at a very small angle to the tail. It was visible on October 3rd, 4th, 5th and 7th, in the plates, but was not visible on the 12th and the following dates.

Automobile

Hungary Motorizes Postal Service.—By order of the Hungarian Ministry of Commerce six hundred motor vehicles are to be purchased by the postal department. The equipment will include 250 small cars of about 10 horse-power for letter collection, to replace the present motor tricycles and bicycles, 75 combined passenger and parcel 'buses, and 275 delivery wagons of from 16 to 30 horse-power for parcels exclusively.

New World's Record for 1,000 Miles.—In an official race against time at the Brooklands track in England, a 15.9 horse-power (British R. A. C. rating) Sunbeam car established new world's records for all distances above 850 miles. The little car made the thousand miles in 13 hours, 8 minutes and 25.1 seconds, an average speed of 76 miles an hour. It started the long grind with an average speed of 78 miles and finished with 76.1 miles an hour, during the last hundred miles.

Novel Alarm Signal.—A new automobile alarm signal of unusual construction and equally unusual sound has just been invented by an Englishman. It consists of a gong placed in proximity to the revolving cooling fan, the blades of which hold small striker arms. By means of a Bowden wire cable the gong can be held against the fan, so that a penetrating but not unpleasant warning sound is introduced. The resulting note is said to be similar to that of a "slip carriage" coming into the railway station.

A Crank With Folding Handle.—A novel type of automobile cranking handle, in which the danger of a "kick" is materially reduced, has just been put on the market. The device consists of a folding handle, which, when released by the hand or torn from its grip by a "backfire," jumps into the same plane as the cranking arm, thereby reducing the width of the "danger zone" to one inch, instead of the five inches swept by a rigid handle. The power needed to throw the handle out of the way is furnished by a stiff spring.

Electrics for Theater Demonstrations.—In order to impress the general public with the suitability of electric automobiles for theater parties, one of the New York agencies offered free transportation from home to any of the Broadway theaters to *bona fide* theater parties. And several tests made by intending purchasers and mere curious show-visitors proved that the offer was genuine—the agents actually *did* give the free rides—to the extreme satisfaction of their passengers. Although the cost of these trips is a considerable item in the expense account of the agency, it is said that it is the best advertising and publicity that could possibly be obtained.

Novel Armored Tire Appears.—An armored tire which is giving excellent service in trials at present conducted by the Royal Automobile Club of Great Britain is the Stelastic, manufactured in Westminster. The carcass of the tire resembles the ordinary pneumatic, but in the tread are interwoven a series of spiral springs, which offer an absolutely impenetrable shield to nails, glass and tacks, besides prolonging the life of the tire by reason of their great tensile strength. There are no less than 90,000 of these small springs in a 36×5 tire, and the only thing that can penetrate this armor is a long thin nail (part of a hatpin) entering at just the right angle to slip between the coils of the spring. It is also claimed that the tire does not get heated so quickly, as the steel springs disseminate the heat over a larger area.

Automobile for Town Use.—As a ladies' car for operation by ladies about town, the electric runabout has always been a favorite, although many women operate even large gasoline cars. Attempts are being made, however, to popularize small gas cars among women. The objection to cranking is removed by self-starting devices. The provision of a popular gas car for operation by a woman will demand the attention of both designer and inventor. It must be graceful and its engine must run smooth, while the engine control and transmission should be effected in the simplest way. It would not demand a high-speed capacity, and, if needed, some auxiliary heating devices must be supplied to keep the parts warmed up so that the starter would operate in the coldest weather. A car filling the bill at a reasonable cost should find favor among women.

Substitutes for the Pneumatic Tire.—It is safe to say that no subject has received more careful thought and attention from inventors within the last year than the tire problem. But not one of the scores of recently patented devices is quite equal to the plain artillery wheel fitted with pneumatic tire. Most of the devices employ springs to take up the jar between the tire and the axle and use solid rubber or similar material for the actual tread of the tire. Ingenious as many of these schemes are they are bound to be less serviceable than the pneumatic tire due to the number of moving parts which are subject to wear and breakage. Furthermore, there is a great tendency to rattle and jar whenever a small obstruction is met by the tire. So, although the problem of substitute for pneumatic tires has not been entirely solved, much work is being done and it is apparently only a matter of time until we may expect something even better than the present pneumatic tire.

Magnetic Chucks for Machine Tools

By Joseph B. Baker

TIME saving in manufacturing work is of great importance in the present day of rapid production and high cost of labor, and any device that will cut out the waste of even small amounts of time in a given operation is sure to be adopted by progressive manufacturers. In the machine shop the full economy in the operation of the machine tools is often not brought out by the workman, on account of the time and labor wasted in setting up or "chucking" the work of the tool. A familiar example may be found in the work of the shaper. This tool's efficient work on an iron casting or other piece, for example, can not begin until the piece has been secured to the bed of the tool. It requires care to make sure of a firm hold on the piece without buckling or distorting it by too much clamping force, and the piece may be of such size or shape that it cannot be readily held mechanically without leaving the clamp itself in the way of the cutting tool, so that this making ready to do the work is likely to be a tedious and time consuming job out of all proportion to the time required to do the actual work itself.

The magnetic chuck, a recently improved device for holding iron and steel pieces to be machined on shapers, planers, milling and grinding machines, and other machine-shop tools, is designed to remedy this condition, that is, to minimize idle time. The device is given its holding power by coils of insulated wire constituting a winding for generating a magnetic field at the face of the device—a field powerful enough to grip firmly the iron or steel piece simply laid on the face. As applied on grinding machines for grinding flat surfaces the magnetic chuck consists of a flat, horizontal or vertical plate of iron beneath the face of which the winding is arranged so as to give a series of magnet poles in the face. Terminals of the winding are brought out to a variable resistance operated by a convenient handle (by which the strength of the magnetism can be controlled by the operator on the machine tool) and to a switch for making the necessary connection with the electric lighting or power circuit of the machine shop.

Direct current must, of course, be used to energize the magnetic chuck, and where the shop has alternating current only, it is necessary to provide a small motor generator to transform the current. The series of electromagnet poles which are made in the iron bed when the current is turned on are indicated in the horizontal chuck of this type shown in one of the illustrations. This chuck has adjustable end and side stops, raised above the surface of the bed, to help in holding the piece by taking the direct strain of the grinding wheel or other cutting tool which would otherwise tend to shift the piece along on the bed. A valuable use of this flat chuck is for the accurate grinding of thin pieces such as dies, knives for woodworking machines, gage plates, etc., which could not be held by mechanical clamps without distortion.

Rotary chucks are also made especially adapted for holding ball races while being ground to finished size, and for grinding with high precision the pistons of gasoline engines and piston rings to fit ring grooves. Magnetic chucks may be used in groups, as in holding long pieces on a planer or milling machine or in holding a number of pieces of similar size and shape to be machined at one operation.

A magnetic chuck for practical machine shop use will inevitably be exposed to careless handling, as by being subjected to a higher voltage than that for which it is designed, and to oil, moisture and mechanical mishandling, and it is necessary to guard against the grounding of the wire windings on the frame of the machine tool and against burning out of the windings. Accordingly, the wire is insulated with a moisture-proof preparation of pure asbestos, which is also sufficiently heat-proof to protect the coil from burning out, or from becoming grounded, even should the temperature rise to 400 deg. Fahr. As an additional measure to keep the chuck in working order, the winding is made in the form of a set of independent, interchangeable units which can readily be removed or replaced by the operator of the tool.

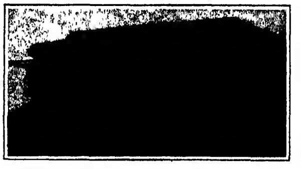
An interesting feature in the practical use of the magnetic chuck is the demagnetizing switch, which is provided to release the work quickly by overcoming residual magnetism.

Rotary chucks for facing piston rings and the like with great precision.

Rotary chuck with an auxiliary plate for holding ball races, etc.

Nine-foot swiveling magnetic chuck for grinding long knives.

Flat magnetic chuck with demagnetizing switch.



Flat chuck measuring 5 by 2 feet and 30-inch rotary chuck for surface grinding.

Microscopic Crystal Forms as Suggestions for Designers

ART forms are not produced by nature, for art and nature are radically different. A natural form may, however, be converted into an art form by a process of selection and transformation which makes it a fitting member of the regular and harmonious combination, created by and for the human mind alone, which is called a work of art. The natural forms which the artist finds most inspiring are those which offer the greatest possibilities of such artistic transformation and combination.

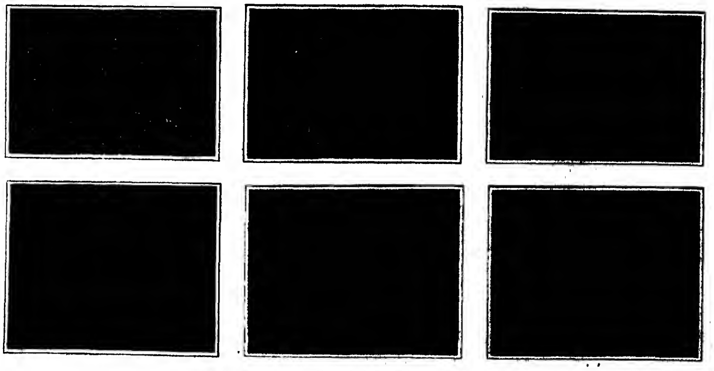
In painting and sculpture this process is very complex, because the artist seeks to produce an illusion (not an imitation) of nature, and also endeavors to create profound mental impressions by harmony of line, mass and color. In applied art it is complicated by the conflict between practical requirements and aesthetic ideals. The process is least complex in decorative art, with its simple laws and limited possibilities.

Pure ornament, applied to the decoration of surfaces, is the field of art which is farthest removed from nature and her laws, and which affords the freest play to the artist's fancy, but it is capable of giving only a vague expression to ideas and moods, except those associated with such of its elements as are manifestly taken directly from nature. The forms suitable for surface decoration comprise abstract and geometrical forms, which depend for their effect entirely upon rhythm of lines and masses, and those natural forms which derive their beauty from superficial contour, pattern and color, in contradistinction to forms unthinkable in two dimensions, such as human and animal figures, which appear unnaturally and violently flattened when used as superficial ornaments. In many cases the effect of the elementary ornamental forms is subordinated to the effect of a harmonious combination of them, repeated at regular intervals. Textile designs, for example, consist of such recurring groups of subordinated elements.

As decorative art departs so widely from nature, which it merely suggests in some of its lines and forms, until in geometrical designs it becomes the embodiment of an abstract law, the natural forms which it should find the most useful and inspiring are those which are produced by natural forces acting in a plane.

A few such forms are shown in the accompanying illustrations, which represent micro-photographs of minute crystals, formed by the evaporation of various solutions on microscope slides. The formation, movements and arrangement of these crystals may be regarded as abstract expressions of natural forces acting in a plane.

These crystalline forms are not art forms, as has already been noted, but they present so many points of contact with the art of surface adornment that it seems proper to recommend them to decorators and designers as worthy objects of study and probable sources of inspiration.—*Adapted from Prof. K. S. von Eisenwerth.*



Crystal forms as suggestions for decorators and designers.

A Heat-proof Bronzing Fluid.—Bronzing fluids as ordinarily made do not stand very high temperatures. Where this is desirable use the following mixture: Cut "gear varnish" or any hard varnish with turpentine to the consistency of thin molasses, add ten per cent of amyl acetate and stir in aluminium powder or other bronzing powder to suit.

The Fourth Paris Aviation Salon

Review of the Show With Mention of the Improvements During the Past Year

THE annual aero show in Paris this year differs from those formerly held in the fact that it was devoted entirely to aviation. There were no dirigibles on exhibition, and there were but two balloons to remind one of the manner in which the air was formerly navigated from the days of Montgolfier.

The number of machines on view increased from forty-three last year to seventy-seven this year. Of these, twenty-seven were supplied by the French government, and were part of the fleet of military aeroplanes which is soon to be increased to well over four hundred machines at an expenditure in 1913 of $5,000,000 in addition to the $4,000,000 spent this year. Of the machines exhibited, forty-six were monoplanes and twenty biplanes, so it can be seen that the single-surface type has become far more popular, and is rapidly displacing the "match-box," as some of the monoplane's disciples have dubbed the biplane.

The most noticeable feature of the show this year was the fact that nearly all the machines are intended for military use. Officers from the various foreign governments were constantly inspecting these machines, and giving orders for considerable numbers of them throughout the two weeks of the show. The contests for military aeroplanes, held in France a year ago and in England last September, have brought forth many excellent war machines of a staunchness and stability that could hardly be surpassed. While the monoplane is used chiefly for speed work and scouting, the biplane is also used for the latter purpose and especially for bomb-dropping, as it is capable of carrying great weights. The monoplane, too, for that matter, has shown itself to have a very high capacity in this respect.

The development of the hydro-aeroplane, or flying boat, as it is now becoming, has been rapid during the past year. Introduced into France last March by Louis Paulhan, when he appeared at the Monaco meet with a Curtiss hydro-aeroplane, these machines have found favor with all aviators, and have increased in considerable numbers. Practically all the well-known manufacturers equip their monoplanes or biplanes with floats for the purpose of converting them into water machines. The next development was the Donnet-Lévêque flying boat, in which the monoplane body of a biplane was made to serve as a single step hydroplane, forming a substantial boat, and thus the makeshift floats were done away with. A large number of flights were made by Lieut. Conneau in one of these machines, and Curtiss is now producing a similar machine in this country. In the Donnet-Lévêque and Curtiss flying boats, the motor is placed high up beneath the upper plane, and carries the propeller on its crankshaft at the rear; but in several which were exhibited at the show, an example of which is the D'Artois, shown in our illustration above, the motor is placed in the hull and drives the four-bladed propeller by means of sprockets and chain. This arrangement lowers the center of gravity, but does not seem to disturb the stability of the machine, as it has generally been supposed a low center of gravity will do. The land biplane shown in this same illustration is constructed along the lines of the Paulhan-Tatin torpedo, that was exhibited last year. The motor is placed in the fuselage behind the aviator's seat, and drives the propeller at the extreme rear end of the fuselage by means of a long shaft. Gallaudet, in this country, constructed a monoplane for the International cup race along these lines last spring, but smashed his machine in its trial flight. He is now working on a hydro-monoplane of the same type, which has been found to be very fast. The D'Artois is the first biplane having the propeller at the rear of the body. With a 50 horse-power motor it is said to develop a speed of 65 miles an hour. These machines have another novel feature, namely, the turning of the wings about a central main longitudinal for the transverse stability, instead of warping the wings. They were the only example of lateral stability maintained by other means than warping. Of course, the angle of incidence is varied by this method of control, which is the same as was used by Mr. Gallaudet on his monoplane mentioned above. Practically all the machines exhibited used warpable wings or ailerons for the transverse equilibrium.

The D'Artois flying boat and torpedo biplane.

In both biplanes the motor is in the body behind the aviator's seat. In the torpedo the propeller is at extreme rear end of body

There were a number of new devices for automatic stability shown, and models or full-sized machines for their demonstration. The Doutre stabilizer—a vertical plate in front of the machine which moves according to the variation in pressure and sets the elevator correspondingly—was shown this year fitted to a full-sized biplane. M. Hugnet exhibited a similar stabilizer, which is said to be an improvement upon the Doutre. The principal machine having automatic stability, however, was that of the Moreau brothers. This was a large biplane fitted with a 70 horse-power motor and an underslung car pivoted to swing and act as a pendulum. Messrs. Albert and André Moreau have been developing their "Aerostable" for the past ten years, and the latter made successful flights two years ago in a monoplane having an underslung car used as a pendulum for the purpose of setting the elevator. He has flown over 12,000 miles since April, 1911, in this machine, and on

The 80 horse-power Deperdussin "Monocoque"—the fastest type monoplane.

Salmson parallel-cylinder motor.

L'Aviator two-cycle circular motor, which is water cooled.

100 horse-power Astra triplace hydro-biplane, winner of St. Malo-Jersey race.

several occasions has flown for ten minutes at a time with his arms folded. On October 15th last, his monoplane carried four men, making a total weight of 1,760 pounds for a surface of 258 square feet. The Moreau machine was the only really new aéroplane on exhibition. MM. Moreau expect shortly to bring out an automatic device for maintaining the transverse equilibrium as well.

Besides the machines above mentioned, the two remaining features of the show were the "Monocoque"—a type of monoplane having a cylindrical torpedo-shaped body, as shown in the Deperdussin we illustrate—and the hydro-aeroplanes. The "Monocoque" was developed from the Paulhan-Tatin torpedo, above mentioned. The bodies of these machines are constructed of veneer, tulip wood having been found the best for this purpose. They are very strong and smooth, and produce very slight resistance because of their shape, and diminished skin friction because of their short length. Louis Blériot has brought out a machine of this type having a half-round body on the under side. He has also changed the undercarriage of his monoplanes so that they now have two wheels with a connecting axle and a central upturned skid. His latest invention is a hydro-pneumatic shock absorber for the central mast extending down to the undercarriage.

The development of the all-metal aeroplane has been quite rapid during the past year. A half dozen or more constructors exhibited machines made largely of steel tubing and sheet aluminium in the Salon this year. Robert Esnault-Pelterie, it will be remembered, was the first to construct a steel-tube fuselage, and this is still used on the R. E. P. monoplanes. The Hanriot firm is now following suit, and also the Clement, and one or two others. Last year the Tubavion all-metal monoplane was the only one of its kind, while this year there were several, the chief one being the Hanriot. Leading authorities agree, however, that a proper combination of steel and wood is far more satisfactory than a machine built entirely of metal.

The modifications of the various types of aeroplanes on exhibition were slight, with the exception of but two points. First, there has been a general lowering of the center of gravity on many of the aeroplanes, and second, they have been fitted chiefly with non-lifting tails. In the case of the biplanes, single-surface tails are generally employed instead of double, and only a few biplanes are fitted with elevators both fore and aft. There has been a slight endeavor to obtain automatic longitudinal stability by means of wings having a reverse curvature toward the rear, in accordance with Turnbull's experiments repeated latterly by Eiffel. The Besson and Bristol (English) monoplanes have such wings. On the whole, however, the curved wing has been displaced by the almost flat wing, having a sharp entering edge in order to reduce the resistance and allow of the highest possible speed being maintained. Speed in itself produces stability, and most of the monoplane constructors, at least, aim to attain the greatest possible speed.

When once the need of Europe for war avions is filled, the French and other nations will doubtless turn their activities toward the production of commercial aeroplanes. The hydro-aeroplane, or hydraeroplane, has done much toward the commercializing of aviation, and no doubt another year will see many water aeroplanes in use in the United States, as well as throughout Europe.

A very complete description of the most interesting machines and motors at the Salon will be found in the current SUPPLEMENT, 1926.

Some Developments in Wireless—II

By John Hays Hammond, Jr.

(Concluded from page 438, November 23, 1912.)

The Possibilities of Duplex and Quadruplex Wireless.

The development in the immediate future in wireless lines, it seems to me, will closely parallel the advances made in wireless telegraphy and telephony. Facilities to increase the amount of intelligence handled will be one of the first developments. Duplex and ultimately quadruplex wireless systems will come into general use. The Marconi Company has already developed a duplex system and is employing it for commercial work. The problem of multiplex wireless telegraphy is again intimately connected with the problem of selectivity; for it is necessary to individualize each individual message so that there shall be no intermixing or interference in simultaneous transmission or reception.

In wireless telephonic work, we may confidently expect a development that will bring it into general use. The necessary apparatus will be simplified and made fool-proof to an extent that will allow its use on the farm, in isolated mining camps, and in many places where a line wire connection would mean the expenditure of thousands of dollars. The flexibility of the system, its small initial cost, and the advantage gained in doing away with the need of central stations will bring the wireless telephone into commercial favor. Greater selectivity along this line is a present day problem and presents greater difficulties than the attainment of non-interferability in wireless telegraphy.

High Speed Wireless Telegraphy.

Eventually, I believe that it will be possible to develop high speed systems of wireless telegraphy for the transmission of news. To-day, we have rapid wire telegraphs capable of transmitting over wires at the remarkable speed of 5,000 words a minute. Perhaps along lines of chemical research a substance will be found which will change color under the action of minute electrical oscillations. With the discovery of such a suitable substance we could duplicate the rapidity of the Delany system in wireless transmission.

A further important development in electro-magnetic wave signaling is embodied in the inventions of Ernst Ruhmer, of Berlin, and Major Squier, of the United States Army. These two brilliant scientific researchers evolved the idea simultaneously, but independently, of applying wireless transmission to wires. By utilizing the principles of electrical tuning to wire telegraph and telephone systems, it has been found possible to multiplex a line and thus transmit a far greater number of messages simultaneously than can be done with present day installations. The telephone system would benefit materially with the adoption of such a system after it had been perfected, and the increased cost of operation would not be, as it is now, proportional to the increased number of subscribers. However, certain essential difficulties still stand in the way of the immediate general adoption of this system, one of which is the effect of forced oscillations produced on the receiving apparatus by the transmitter at the same station.

Outside of its use as a valuable means to signal through space, the electro-magnetic waves of the future will accomplish results of even greater value to humanity. To-day we are just on the threshold of a great science which Nikola Tesla has aptly named "telautomatics."

Action at a Distance Wirelessly Controlled.

Telautomatics is the control of a number of mechanisms from a distance with only a single conducting medium, besides the ground, connecting the operator and mechanism operated. The most spectacular branch of this art is in the wireless control of mechanism. Torpedoes have been guided by wireless. Clocks are being run to-day in Europe by wireless. Bells on buoys have been made to ring from the deck of passing steamers. A railroad locomotive has been operated without an engineer in the cab, and numerous other feats have been performed with only a ground and the ether connecting the operator and mechanism operated.

Prof. Ernst Wilson in 1897 controlled a torpedo on the Thames by Hertzian waves. He is the pioneer inventor in this art. Since his time a large number of telautomatic patents have been granted, both here and abroad.

This electro-magnetic arm which we can stretch through space, and use to control machinery, is the next great step in the stairway of progress following the annihilation of distance by the electro-magnetic voice. I believe it will be an important scientific factor in the civilization of the future.

To-day navigation is being safeguarded by the use of the Bellini Tosi system of directive wireless telegraphy. Bellini and Tosi have developed what they call a Hertzian azimuth compass. At a demonstration which I witnessed in Paris, it was revealed that this instrument would show within one degree at a distance of 50 miles the actual direction of reception of a wireless message. This means that when lighthouses are equipped with wireless plants, it will be possible for a captain to ascertain his exact position by comparing the direction of reception of two signals sent from two different lighthouses. The lighthouses will be distinguished from each other by different acoustic notes.

Another important invention is that of R. H. Marriott, patented in 1909. This invention is based upon the fact that sound waves travel at a specific rate through water, and wireless waves travel at such a high velocity that their time of transit from a nearby station is a negligible lapse of time. Mr. Marriott, therefore, proposes to have a submarine bell sound simultaneously with a wireless signal at a lighthouse or on a ship. The navigator then listens in, and calculates the difference in time between the reception of the bell signal and the reception of the wireless signal. From this difference of time, he immediately knows the exact distance between his vessel and the lighthouse or ship. Thus, in fogs we will be able to navigate, thanks to wireless, with an exact knowledge of our bearings and the distance we are from other vessels.

The transmission of photographs is already an accomplished fact in wireless, and when television is possible over wires, there is no doubt that we shall be able to see over the edge of the horizon by wireless.

Prof. Fessenden has shown a method of transmitting handwriting by wireless and there are newspaper rumors of an Italian system to transmit drawings for military purposes.

The important question is not, what it is possible to do in the future in wireless, but what is it practical to do. Economic considerations will determine this.

Whatever may be the ultimate developments of wireless, it is evident to-day that we are just entering into a field of science whose attainments will have a far-reaching influence on the shaping of our civilization.

The Rediscovery of America

THE Englishwoman who remarked, *àpropos* of our civil war, that it was no wonder the North and South had become disunited in spirit since they "were only connected by a narrow isthmus," may conceivably have been a woman of parts and education according to European standards. American geography hovers on the outskirts of Old World curricula—a thing for the hobby-rider or the advanced specialist. This is true in whatever sense we use the elastic term "geography."

We believe, however, that dating from the autumn of 1912 our transatlantic brethren will have no excuse whatever for not knowing as much about our country as they know, for instance, about Turkestan or the Gold Coast. It was an heroic idea on the part of the American Geographical Society, in commemoration of its sixtieth birthday, to corral the most eminent geographers and geographical teachers of the Old World, place them aboard a special train under the strict surveillance of Prof. W. M. Davis (a genius at "personal conducting") and a staff of polite but inflexible assistants, and force them, whether they would or no, to see about ten times as much of this country as the average enlightened American may hope to see in the course of a lifetime. The Transcontinental Excursion of the American Geographical Society, which began in New York in August and ended in the same city two months later, was, in many respects, the most conscientiously executed exploring expedition on record, and is certainly likely to be one of the most momentous in its results. The journey covered about 13,000 miles, including 1,000 miles of automobiling. The country along the route simply turned itself inside out for the benefit of the forty-three foreign visitors. American hospitality outdid itself. Everything that could conceivably interest the foreigners, and possibly much that could not, was trotted out, exhibited, put through its paces. The local magnates, from State governors down, were on hand at the gates of the cities to bid the visitors welcome; banquets and receptions filled all the intervals of sight-seeing. The choicest products of every locality visited—fruit, flowers, and what-not—were heaped upon the travelers, loaded aboard their train, even sent to their European addresses to await their return. Quite the most remarkable fact in connection with the trip was that, with one exception, the Europeans proved physically equal to the strenuous round of sight-seeing and entertainments. The next most remarkable fact was that representatives of thirteen countries spent two months in one another's company, mostly in close quarters, without the slightest breach of amicable relations.

Except the last lap of the journey, from Washington to New York, the trip was all made on the same train, and only one slight change in the itinerary planned in advance was made necessary by the fact that the party was delayed 24 hours at the Roosevelt Dam by an almost unheard of rain of two inches, which made the mountain roads impassable for automobiles. A daily bulletin, containing the announcements and information of the day, was printed on the train. A feature of the equipment was a "Guide Book for the Transcontinental Excursion of 1912," of 144 pages, compiled by Prof. Davis. A well-stocked library was carried along, containing books and maps relating to the region traversed. About a dozen American geographers made the whole journey, and some sixty more accompanied the party in relays, as guides to the expedition. The enterprise was admirably organized from beginning to end.

It is safe to assert that the class rooms and lecture halls of Europe will for some time to come be the distributing centers of accurate, first-hand information about the once *terra incognita*, America.

Sugar Beets in Dutch East Indies

A MOST interesting experiment in the cultivation of sugar beets has recently been made near Batu in Malang, Java, at an altitude of 2,600 feet above sea level. The beets were grown from seed obtained from Erfurt in Germany, and were a great success, weighing on an average from two thirds of a pound to a pound without the leaves. That is much heavier than those grown in Europe. The content of sugar was 15½ per cent, whereas in Europe the average is less.

According to a scientific computation the production of sugar per acre would be 2½ times as great as that in Europe.

Does not this means suggest the possibility of sugar beet cultivation in the Philippines and other American colonies?

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Water Propellers for Ships

To the Editor of the SCIENTIFIC AMERICAN:

I observe in SCIENTIFIC AMERICAN of September 21st—the most interesting and instructive paper that as I think now exists—you mention under the heading of "Auxiliary Sailing Schooners" the suggestion that they should be equipped with auxiliary engines.

Will you permit me to suggest that it might be worth the consideration of the owners of such vessels, whether they might not advantageously adopt the water propeller. Your readers will no doubt be aware that the water propeller has great advantages over the screw in regard to economy, as its action on the ship takes immediate effect, and there is none of that waste through the screw requiring to be revolved up to the then speed of the vessel before the auxiliary takes effect.

The water propeller was tried during the sixties, probably in the year 1864.

The only fair trial that it had, as I thought at the time, was in the case of three gunboats, the "Vixen," "Viper" and "Waterwitch." The vessels were, I believe, identical in form and in power exerted. "Vixen" and "Viper" were screws, the "Waterwitch" had the water propeller. The result showed that there was practically no difference in speed; and it should be remembered that no sufficient trials were ever made to ascertain the best position and mode of exit of the water.

The handiness of this propeller for starting ahead, stopping, and going astern was greatly superior. The trouble with the screw having to be feathered is avoided. The motion of the centrifugal pumping engine, acting like a great gyroscope, tended to steady the ship.

I should add that a rough estimate was made, when an ironclad was rammed in the Irish Channel and sank in a little over an hour, many years ago, as to the amount of water that was likely to have come into the ship, and it was found that if she had had a water propeller, the amount that came in through the hole would only have been sufficient to give her three quarters speed.

Talmer Slough, England. J. NUTTALL.

Non-astringent Persimmons

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of October 26th of the SCIENTIFIC AMERICAN I notice an article on "Non-astringent Persimmons." In this connection I wish to state that I have bought at fruit stands in a number of Florida towns, during a number of years past, a variety of Japanese persimmon locally known as "apple persimmon," which is so called on account of the fact that, when taken from the tree, this particular variety is free of all tendency to pucker, and can be eaten at once just as would an apple. When picked ripe, it is firm and fully colored, good flavored and sweet, and decidedly pleasant to the taste. When bitten, the bite comes out with a crisp snap.

I at one time lived next door to a man who grew some of this variety of persimmons in his yard, and know that they were treated in no way to give them the qualities mentioned. E. W. PRICE.

Tampa, Fla.

Ocean Currents

To the Editor of the SCIENTIFIC AMERICAN:

About the time the "Titanic" was sunk, I read an article in your paper in which the Labrador current was alluded to in terms which seemed to indicate that its cause or origin was obscure or unknown.

Looking the matter up in several encyclopedias since, I find that there is an almost total lack of definite information as to any of the ocean currents, including the Gulf Stream.

For many years I have had the idea that the Gulf Stream, as well as the ocean currents of the eastern hemisphere, were the result of the inertia of the waters of the oceans against the rotation of the earth, piling up enormous masses of water against the eastern shores of both hemispheres, and flowing away on lines of least resistance.

A casual study of the streams from this viewpoint will, I am sure, make my idea perfectly plain, and, considered in connection with the heat at the equator and the cold at the poles, provide an accurate determination of the source, direction, and effect of every current in the seas.

This idea may not be new, for, as stated above, I have held it for a long time, but certainly such sources of information as have been available to me recently do not convey any definite idea of the causes. If there is any novelty or value in this suggestion, please give it to your readers; otherwise, please destroy this letter and kindly direct me to some suitable writings on the subject.

RICHARD A. MAGILL.

Atlanta, Ga.

Solving the Christmas Gift Problem

A LARGE manufacturer recently wrote us as follows:

> "We send out Christmas presents to some of our customers. Suppose we sent you from twenty to fifty subscriptions, what is the lowest price you could make us."

We replied to our correspondent's letter and quoted a special price. The following extract tells the story.

> "Go ahead and have one hundred and fifty cards printed reading as follows.

We take much pleasure in advising you that the Scientific American will be sent to your address during the coming year, with the compliments of ________

Our correspondent is not only saved the worry and bother of attending to the details of having the gifts delivered at the proper time, but the arrival of the SCIENTIFIC AMERICAN each week during the year serves to recall to the minds of the recipients pleasant memories of the donor.

If it is your practice to give Christmas presents to your customers or employees, a year's subscription for SCIENTIFIC AMERICAN, or a copy of the "SCIENTIFIC AMERICAN Reference Book," or better still, both in combination, makes an ideal gift, that is of permanent value to the recipient.

A Promise Unfulfilled

To the Editor of the SCIENTIFIC AMERICAN:

I cannot help from feeling that it is my duty to express myself along the lines of thought you conveyed so accurately to the scientific and literary world in your paper published September 21st, 1912.

This subject, "A Promise Unfulfilled," dealing with America's slow advancement in aero-navigation, is a serious subject, and the causes are just as you say, "More national than individual." I have always thought that large or good-sized cities were the places to organize and get money for this work. This may be so in the North, but it has not been so in this part of the South, and to illustrate to you that what I say is true, the following outline should be convincing.

A little over two years ago two men started actual work on this subject in one part of this city. About the same time two other men started work along the same subject in another part of the city. Now, I am in a position to know that not a single man of the four had any intention of building a flying machine, jumping into it, and flying off, as 'tis the dream of so many people; for they all knew that experimenting, studying, and hard work were necessary first. There was little capital available among the four men, but by two men devoting their entire time and using to good advantage the little money they had, flying models and gliders were constructed; later the experimenters consolidated, and large machines were constructed. One machine was fitted up with a 20 horse-power Buick motor, and with this machine the men made use of such experiences as they could get traveling and falling around on the ground. No attempt was made to fly, and "Why not?" was explained to a number of people.

Soon the time came to do more. Large, up-to-date machines were constructed of the best material and workmanship available (following plans obtained from a northern concern). To install in one of these machines a cheap motor would have been foolish, and to buy a good motor the sum of $225 more than what they had on hand was necessary. They tried to raise this amount here. Every poor man and rich man was cornered; they had material on hand worth four times $225, and this was offered for collateral but they were still unable to raise the required sum here. I will say, just here, that this city has about forty thousand inhabitants, a number of whom are of considerable wealth; it is a city of self-pride and enthusiasm; and a boaster of its place in history. No one was asked to give the money away, but nevertheless on no condition could the $225 be obtained for the purpose of experiments in aero-navigation.

About 21 miles from this city there lies a little town of about four thousand people, that is called by some people here a country town. Regardless of what it is called, right in the town of Gastonia, N. C., they obtained the $225 and a little more to carry on their work. A $1,200 Maxi motor was ordered at once.

What America needs along the line of preparing a machine or scientific article for the market is a little more of the German spirit. He organizes a company first for the purpose of experimenting with the articles. The Germans have confidence in what they are doing, they expect results, and they get good results. This nation as a whole tries to get rich too quick.

When you compare this nation's strength in aviation to that of a single foreign nation, by representing that foreign nation's strength as the largest flying machine, and this nation's strength as a tiny butterfly, every true-born American should fell ashamed. Flying machines may seem foolish to a lot of people; but when one reads in the daily newspapers of what the machines have done in time of war, one should stop to think what this nation could do in time of war. They should know that most of the foreign countries are prepared to fight with the help of air scouts, while we are not

Patience and a little more confidence will bring results, especially in a country which is the birthplace of the men who traveled long and hard roads to give this nation as well as to the rest of a world a concrete foundation on which rests the successful flying machine.

Charlotte, N. C. A. M. WEBB.

Automobile Toll Roads

To the Editor of the SCIENTIFIC AMERICAN

If charters were granted by States to corporations for the purpose of building important State and interstate roads for the exclusive use of rubber-tired motor-driven vehicles, the plan would, I believe, be the best way to secure a good many economically built and carefully kept roads.

For such a road to pay dividends it would have to have easy grades and as smooth a surface as could be possibly maintained. Such a road would make possible the use of cheap automobiles, which would be used in great numbers if only proper roads were built for them.

The corporation could keep motor buses and trucks for hauling passengers and freight on such roads for the benefit of the public as well as the corporation, all vehicles to have the same rights on the road.

All vehicles being rubber tired and motor driven would probably not be so wearing on the road as where rubber-tired and iron-tired vehicles are used on the same road. Such a road should not cross public highways at the same level, but go over or under them, not only for safety but also for the purpose of easy collection of tolls. Tolls could be collected in this manner: station agents could be kept at intervals of from four to six miles along the road, where automobiles could be allowed to go on or off the road.

Parties taking an automobile on a road at a station would have to purchase a ticket, and when arriving at the station which the ticket called for, they would have to deliver the ticket and the agent would permit them to leave the road.

In support of the automobile toll road idea I will refer to the great railroad systems of this country, how they have contributed so much to the development of the country under corporation management, how competition has stimulated inventions that have improved and cheapened transportation.

The same thing would happen if automobile toll roads were constructed and managed by corporations. Efficient work would be done in construction and maintenance; competition would stimulate experiment and invention, and the result would be of great benefit without in any way interfering with present public roads, but rather stimulating the building and improving of them.

No considerable number of citizens would care to advocate public ownership of railways, the only general desire has been for some form of just regulation. This being the case, why not have automobile toll roads, built by corporations, between important cities and towns, instead of having such roads built in a haphazard way by counties, at great cost and with no provisions for maintenance.

Stanberry, Mo CLIFTON R. SUMMERS.

The Gyroscopic Torque of a Rotating Body

To the Editor of the SCIENTIFIC AMERICAN.

Apropos of Sir Hiram Maxim's suggestion, in your issue of October 26th, to determine by a special research the gyroscopic torque of a rotating body, permit me to say that the required value of the torque can be found by use of the simple method and well-known formula published in the SCIENTIFIC AMERICAN SUPPLEMENT for March 2nd, 1912. Sir Hiram's proposed apparatus should, of course, yield correct results, but since these can be accurately foretold by computation, the suggested research would at best merely verify a well-established and very reliable theorem in mechanics.

Every engineering student learns how to find the moment of inertia of a body, say of a propeller with reference to its axis. Multiplying this quantity by the speed of rotation times the speed of deviation of axial direction gives the required gyroscopic torque. Thus, starting with a familiar physical quantity, the required torque is found by simple arithmetic.

But, though the computation is so easy, the amateur may very well engage for a few moments some competent person to teach him to perform it correctly. After that he can figure the gyroscopic force of his rotating parts with entire satisfaction, and make a clear estimate of its disturbing effect.

Washington, D. C. A. F. ZAHM.

Asphalt Still a Mysterious Material

By Newton Forest

NOT long since, while walking along one of the streets of the National Capital, I came to a section which had been torn up and was being repaved with nice new asphalt. As the workmen with their huge-soled shoes scurried about smoothing out the hot, smoking stuff preparatory to the steam-roller's finishing touches, the thought came, "What a marvelous material this is!" and I stopped to watch the process. Then I began to search my brain for what I knew about this mysterious material now so generally used. It was soon discovered that I knew little of its history and less about just what it is, so I straightway started a "course in asphalt." There are hundreds of thousands of people who each day pass across streets being paved with asphalt, and like I have done many times, give no more thought to the matter other than the street is being paved, and there is a sign standing in it bearing these words of warning: "DANGER! Look Out for the Steam Roller."

Asphalt as a solid bitumen has lots of history relating to it. The word *bitumen* may be defined as a generic term for a class of minerals, occurring in nature, which are soluble in chloroform and other neutral liquids. They all consist of compounds of carbon and hydrogen, but often contain compounds of nitrogen, sulphur and oxygen also, and in the solid form iron and alumina. While bitumen may be gaseous, liquid or solid, and relatively pure or mixed with solid materials to form rocks, all asphalts belong to the solid forms. The process by which bitumens are formed in nature is still unsettled by geologists or chemists, but that organic matter enters into the process is generally admitted, but how, is a technical problem yet unsolved.

Asphalt was used by the ancients, but not for street paving. Who first suggested asphalt as paving material is not definitely known. In the valley of the Rhone, in Trinidad, and in California, it had been observed that fragments of the bitumen that were jolted from carts were crushed and compacted into a solid rock bed by the wheels of the carts that followed, and the conviction that roadbeds could be constructed of the same material was inevitable. Some time about 1840 attempts were made to pave a street in Paris with asphalt mixed with quartz, and upon a bed of sandstone, but the experiment proved a failure, due to the preparation and in the method of laying it and in the combination selected. Not being discouraged, however, the deduction being drawn that the defect arose not in the asphalt itself, experiments were continued in Paris until a satisfactory mixture was discovered, after which asphalts became known in London and many other European cities. The first asphalt street laid in the United States is claimed by Newark, New Jersey. This was in 1870, and the material came from the lake in Trinidad.

During Bible times and the pre-Christian era in general, asphalt was used almost altogether as a cement, and with very little alteration from the form in which nature supplied it. The ancients used it in the remarkable preservative methods that have brought down to us so curiously intact the embalmed dead of Egypt. Asphalt was used in the construction of the palaces of Nineveh and Babylon, and even in the Tower of Babel it played an important part. The advantages of bitumen appear to have been entirely neglected or forgotten during the Middle Ages, and the substance

(Concluded on page 468.)

The Industrial Daredevil

By P. Harvey Middleton

THE tall building has brought with it the need of a peculiar type of human being—a man who, perched on some flimsy seat five hundred feet in the air, can survey the pavement below with the same equanimity as if he were standing in a first-story window. He is the man who not only builds the skyscraper, but who paints its flagstaff when it is finished, and washes its windows.

Whenever it becomes necessary to touch up the pinnacle of some dome which glitters a few hundred feet from the sidewalk, or to paint with a new coat a flagstaff which seems no larger than a toothpick to the man on the sidewalk, the newspapers invariably devote a column of space to the fearless man who accomplishes the feat. The Metropolitan Tower, which ranks as next to the tallest building of the world, gives ample opportunity for such outbursts of enthusiasm. Its lantern and ball must be touched up now and then, regardless of the fact that it is seven hundred and fifty feet from the sidewalk. Below the lantern is a balcony. To glide up from it to the lantern is a task calculated to strike terror to the heart of the average human being. The last man who performed the task of regilding the globe on top of the lantern outdid anything that had ever been attempted before. The superintendent of the Metropolitan Tower stood aghast when he saw the man Merrill calmly perched on the shoulders of a helper who was, in turn, carried on the shoulders of another, just as if the three were performing feats on the comfortable carpet of a vaudeville stage—this seven hundred-odd feet in the air, with a stiff breeze blowing!

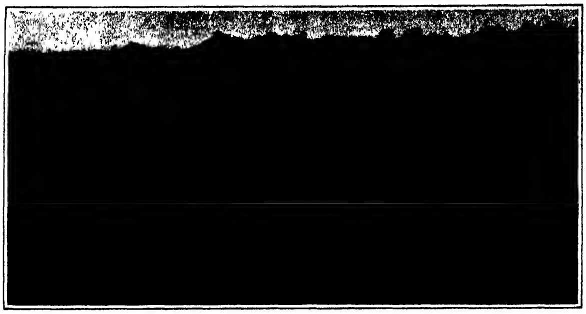
A steeple jack who paints gilded balls at dizzy heights is only one of the many thousands of industrial daredevils. Merrill is just one of many thousands of the industrial daredevils who daily risk their lives in helping to build or to maintain the mighty structures going up into the air or down into the earth of New York city, where new buildings are being constructed at the rate of $225,000,000 annually. Tunnels in connection with the traction facilities of the city that are already constructed, almost completed, and officially agreed upon, amount to $228,267,572. To this can be added $194,250,000 for river tunnels connecting outside passenger traffic with the city's traction lines, to say nothing of the fact that New York has $140,000,000 invested in forty-five bridges over navigable streams.

Go up some day—if you have the nerve—through the many floors of some giant building in course of erection, and watch the groups of brawny iron workers unconcernedly munching their luncheons hundreds of feet in the air, a-straddle of naked beams. When the mid-day meal is over, these aerial workers still have some time on their hands, and as it is far too much trouble to go all the way down to the street, crap shooting is indulged in along the great iron girders—for it is much too windy to play cards! A good deal of money changes hands in these mid-air games, for these men who risk life and limb for five dollars a day, are gamblers almost to a man.

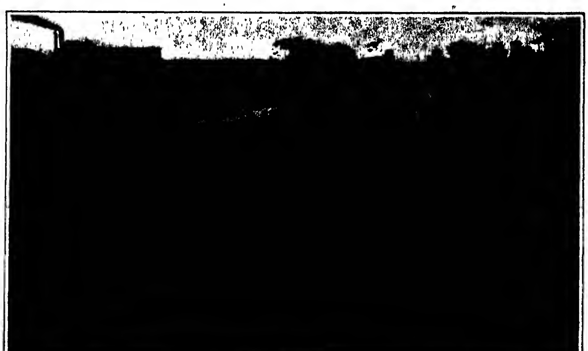
It used to be said that every floor of a skyscraper cost a life, but it is not quite so bad as that nowadays. Yet out of three thousand men engaged in structural work, six hundred and thirteen were either killed or injured in four and a half years. Occasionally you will look up and see a man sitting astride a cornice bracket sticking out from the twenty-fifth floor of a new building. It looks extremely perilous, but accidents seldom happen that way. More mishaps result from the slipping of a wrench than from any other cause. A man is compelled to use his wrench to pry a heavy column or girder. He puts his whole weight against it, it slips, and down he goes to his death.

Another variety of everyday hero is the "sand hog," who digs the great tunnels under our rivers. He works ahead of the shield, drilling and blasting the rock, throwing the gravel and sand from within the cutting edge of the shield through the doors to the car, and wheels the loaded cars away from the "head." He works in three-hour shifts under an artificial air pressure of thirty pounds. He is afflicted with a peculiar disease known as "the bends." No man knows in advance when he will be struck down by this dread disease, and the men gamble freely on whose turn will come next.

That we have made some progress in protecting our workmen, however, is evident by the fact that in the building of New York's very latest river crossing, Manhattan Bridge, only five men were killed. Two of this number, both riveters, fell into the river, one hundred and fifty-five feet below. Two others fell on shore—one hundred and twenty-five feet to the street.



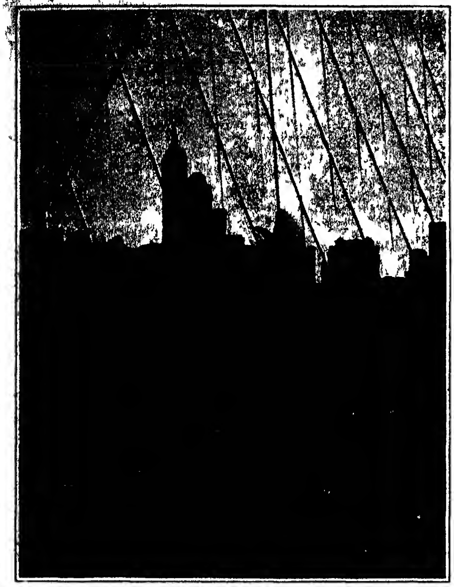
Mining asphalt at Trinidad, which means simply the picking up of the material and loading it in cars. The supply is never exhausted, the deposit renewing itself by natural pressure from below as fast as it is removed.



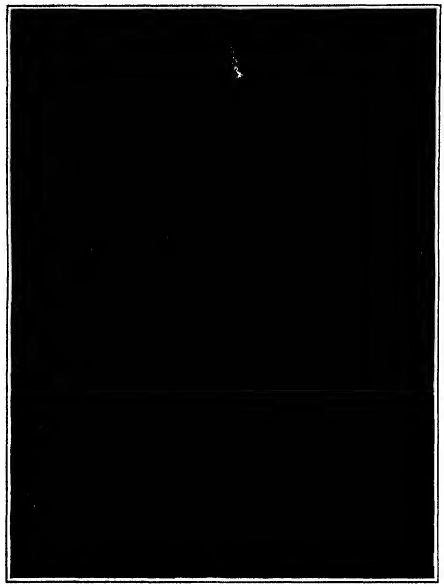
Asphalt Lake at Trinidad, whose bottom has never actually been reached, although believed to be something over one hundred feet below the surface. Method of loosening up the material for loading in cars for transport to nearby wharf.

The International Federation of Expositions

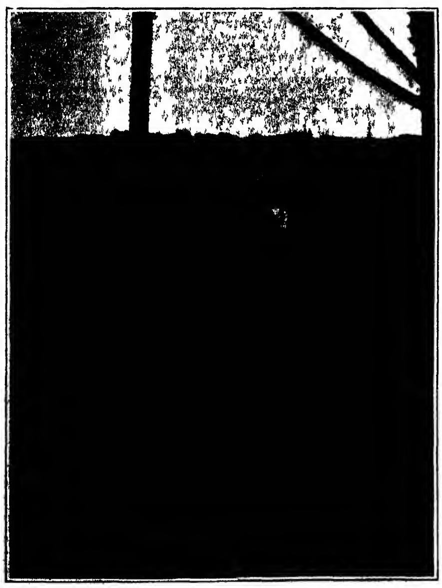
A CONGRESS of a diplomatic character representing no less than twenty-six governments was held on October 7th, at Berlin. It was organized by the International Federation of Exposition Committees, and the congress was occupied with establishing a basis for holding expositions in various countries, and it also took measures to draw up rules for the awarding of prizes on such occasions. In this way all such questions are likely to be settled in a satisfactory manner owing to an international agreement upon exposition matters.



Painting the suspenders of the Brooklyn Bridge.



Sandhogs emerging from an air lock



One of the numerous perils of bridge building.

Steeplejack crawling up between two large smokestacks on a power house.

THE INDUSTRIAL DAREDEVIL

The Heavens in December

Three Comets Now Visible; Directions for Finding the Planet Neptune

By Henry Norris Russell, Ph.D.

THREE comets are now visible in various parts of the heavens, but only with telescopic aid. Gale's comet is still in view in the northern sky, though being in almost the same right ascension as the Sun, it can only be seen just after dark or before dawn. Schaumasse's comet, discovered at Nice last month, has moved very rapidly southward, but is still accessible to observers on the other side of the equator; and a third comet, discovered by Borrelly at Marseilles on November 2d, is visible in the evening sky, its position on December 1st being roughly in 20 hours 10 minutes R. A. and 1 degree north declination (which puts it not far from Theta Aquilae), while its daily motion is about 1½ degrees toward the southeast. Early in November it was visible in an opera glass, but it is receding from the Earth and Sun and growing fainter.

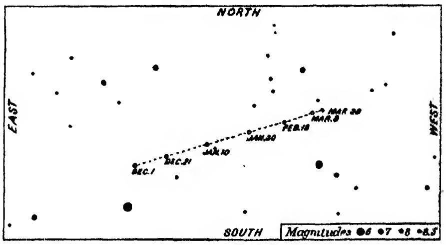
It is to be regretted that more specific instructions for finding this and other comets cannot be given in such articles as the present. The reason for this is that the ephemerides, or predictions of a comet's motion, which are published shortly after its discovery, are purposely made to cover an interval of only a couple of weeks, after which a more accurate calculation of the orbit is made, and a new ephemeris prepared for another month or so, and so on. When these ephemerides appear in foreign publications, they will often have more than half run out before they reach American readers. Except for objects of special interest (such as Halley's comet) the average astronomer has usually at his disposal only predictions that run on for a fortnight or so; and hence articles like the present, which must go to press nearly six weeks before the end of the month with which they deal, cannot give all the information that their writer might wish, for the labor of calculating the comet's motion for this especial purpose would be prohibitive.

These three comets have come almost simultaneously, after a long barren interval, Gale's comet passing perihelion on October 5th, Borrelly's on the 20th, and Schaumasse's on the 25th. All three are now growing fainter, and none of them will be conspicuous.

Schaumasse's comet is, however, of a good deal of interest, for as soon as its orbit was roughly computed it was seen that it was moving in a path very similar to that of a well-known periodic comet—Tuttle's—which last appeared in 1899. But, according to the orbit then computed this comet was not due to return until January, 1914. Fayet, a colleague of the discoverer of the comet on its present return, has however made a preliminary calculation of the motion of Tuttle's comet since 1899, and has found that toward the end of 1900 it passed within 70 million miles of Jupiter, whose attraction considerably modified its period, and accelerated its return by three months.

According to these calculations the comet should have returned to perihelion on October 9th, while Schaumasse's comet was there on October 25th. Only the most important part of the long calculations has yet been performed, and it is very probable that when the action of Jupiter has been more precisely computed, the observed and calculated times of the comet's return will agree exactly.

This comet is of interest on account of its period—13½ years—intermediate between the numerous group with periods varying from five to seven years and the longer periods like that of Halley's comet, and also because of the high inclination of its orbit plane—54½ degrees. Its least distance from the Sun is 95,000,000 miles, and its greatest 970,000,000—rather more than that of Saturn. Its orbit passes within about 7,000,000 miles of that of the Earth, near the point of the latter occupied by us on December 21st. If it had not been influenced by Jupiter, but had returned to perihelion in January, it would have passed very near us, and been a conspicuous object for a few days. As things actually were, its least distance from us was about 100 million miles.



Path of Neptune, 1912-1913.

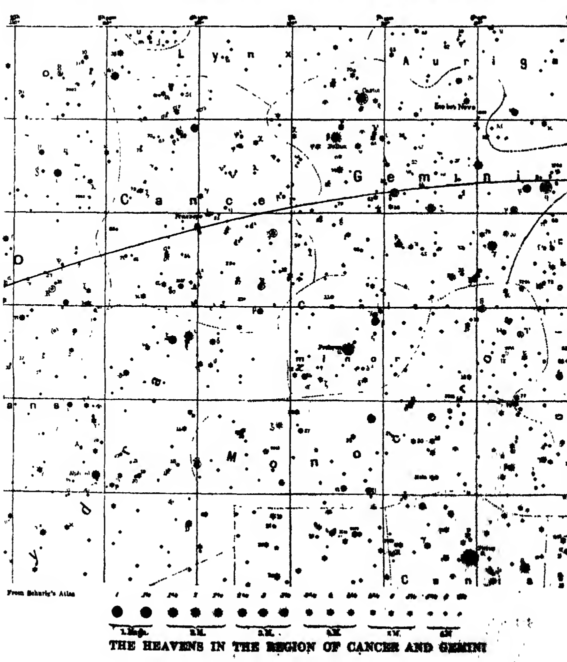
In response to several inquiries we give this month a diagram for the purpose of enabling observers who possess small telescopes to find the planet Neptune. Though Neptune does not come into opposition until January, he is so far north that he is well observable in the latter part of the evening all through December.

The annexed figure shows the region near the planet's path, covering an area 9 degrees by 3 degrees 40 minutes, and including all stars brighter than the ninth magnitude; that is, all those more than one third as bright as the planet, whose stellar magnitude at opposition is 7.7. Observers with an astronomical, or inverting, eyepiece should remember to turn the diagram upside down before using it. To aid in the identification of the region, the detailed star-map, which includes the constellation Gemini, has been reprinted this month. On this, due south of the bright star Pollux, and just below the line of the ecliptic, will be noted the star 79 Geminorum. This, and the somewhat brighter star to the eastward, equally far south of the ecliptic, are the two brightest stars shown on the large-scale map, a little below the path of Neptune. With their aid the planet may easily be found.

A good field-glass should show the planet, though as a pretty faint speck, similar in brightness to the stars marked as of the eighth magnitude on the chart. With a telescope of two or three inches aperture, the peculiar greenish color of the planet may be recognized. At least four inches of aperture, and a trained eye, too, will be needed to recognize any sensible disk.

The Heavens.

The winter constellations are so familiar as to need no prolonged description. Taurus, Orion and Canis Major are resplendent in the southeast, and Gemini and Canis Minor in the east. Leo is rising, and so is the head of Hydra. Ursa Major is low in the northeast, and Draco in the north. Cassiopeia and Cepheus are well up in the northwest, and Cygnus is setting below them. Pegasus, Aries and Pisces are in the west, Cetus and Eridanus in the southwest, and Perseus and Auriga are right overhead. Before leaving this subject, we may call the attention of those who observe Neptune to a number of fine double stars in the same region of the sky: α Geminorum (Castor) is a splendid pair of about 5 seconds separation. κ Geminorum has a companion of 8.5 seconds at a distance of 6.6 seconds, and δ Geminorum one of 8 seconds at a distance of 7 seconds. Both of these are fine objects for a 3-inch telescope. ζ Cancri is a well-known triple. The closer pair, separated by only 1 second, can be resolved only by instruments of 5-inch aperture or more; but the companion 5.5 seconds from this system is separable by small instruments.



THE HEAVENS IN THE REGION OF CANCER AND GEMINI

The Planets.

Mercury is evening star at the beginning of the month, but is too near the Sun to be easily seen. On the 8th he passes through conjunction with the Sun and becomes a morning star. Toward the end of December he is fairly easy to see, rising an hour and a half earlier than the Sun.

Venus is evening star, and is growing brighter and more conspicuous all the time as she comes farther north. By the end of the year she is almost [illegible] degrees from the Sun, and sets a little after 8 P. M.

Mars is just past conjunction with the Sun, and is hardly observable, as he rises only an hour before sunrise.

Jupiter is in conjunction with the Sun on the 18th, and is invisible this month.

Saturn is in Taurus, just

(Concluded on page [illegible].)

A Freak Guide Post

IN Bromley (Kent, England) there has just been erected a post for the guidance of travelers which is certainly unique. It gives directions to such distant points as John o'Groats and Land's End, while one finger indicates the way to Paris. On the top of the post is a model of a biplane, while on the three principal arms are fixed replicas in miniature of a racing motor car, a motor cycle, and a monoplane.

Wreck of the Submarine "F-1"

IN the SCIENTIFIC AMERICAN of October 12th, note was made of the new depth record for submarines established by the boat "F-1," in San Francisco Bay on September 5th. The boat went to a depth of 283 feet. One of the readers of the SCIENTIFIC AMERICAN living in California has sent us a photograph of the wreck of this submarine at Port Watsonville, Monterey Bay, on Friday, October 11th. The wreck resulted from the breaking of her moorings during a heavy sea. Two sailors were carried overboard by a big wave as the boat struck, and lost their lives. The submarine lay on the beach for eight days, but was finally floated again on October 19th, by the combined efforts of the cruiser "Maryland" and the tug "Iroquois." The hull was not damaged, but the engines were practically ruined. The photograph shows the wreck as it appeared at low tide.

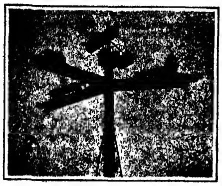
Giant Forest Hogs of Africa

ABOUT the time of the discovery of the okapi, the natives of the Equatorial and Central African forests reported the existance of a large, pig-like animal which they had seen and gave thrilling accounts of the size and ferocity of this unknown beast. Owing to the habit of this creature of roaming only in the almost impenetrable forests and jungles, few white men and explorers have been able to penetrate far into their haunts and kill one. The first specimens to reach America have just been received from Africa and mounted at the Museum of Natural History, New York. The accompanying photograph shows the realistic appearance of these remarkable new comers. They are distinct from the wart hog, Red River hog and bush pig, and considerably larger, standing three feet high and six feet long. Natives report that they attain the size and height of a zebra and a rhinoceros. They are found only in the dense and remote equatorial forests of British East Africa. They are strictly a forest-living animal and seldom come out into the open. To capture or shoot one is very dangerous or difficult. Owing to the thick forest they must be hunted at close range, and they are apt to charge their enemy. The most conspicuous feature of these beasts is their grotesque and formidable head, equipped with huge curved tusks. Below the eyes of the monster is a pair of warty growths, like the fungi which commonly grow on trunks of decaying trees. Their bodies are covered with long, jet black bristles. The giant hogs are supplied with dangerous teeth and tusks, and they prey upon various animal inhabitants of the forests. They are said, savagely to attack native women who are compelled to frequent the interior forests to gather faggots for fire wood. Some of the pigmy tribes of the interior, according to reports of the natives, capture these animals in pitfalls, after which they kill the beasts by shooting them with poisoned arrows. The scientific name of the giant hogs—"*Hylochœrus meinertzhageni*"—is fully as dreadful as the animals themselves.

Motorists' Bridges for Their Exclusive Use

BRIDGES built like car tracks have been installed by the motorists of Southern California to cross streams which are unprovided with regular bridges. While it was possible for teams to ford the streams the heavy machines would sink in the sand, and, therefore, the Automobile Club raised the money to install this unique type of bridge. As there is no roadway between the channels in which the wheels run, no horse-drawn vehicle can make use of the bridges; and this is just, in as much as the motorists paid the entire cost. Although the construction is light and inexpensive, yet it solves the problem very nicely.

Readers are invited to contribute photographs of novel and curious objects, unique occurrences and ingenious contrivances. Such as are found available will be paid for promptly.

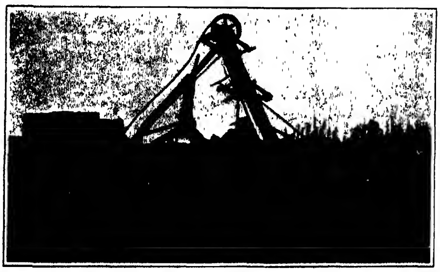


A curious guide post.

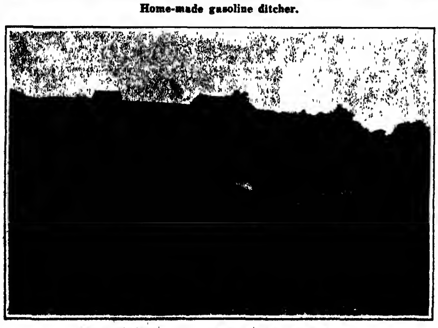
Nickel in the slot bench.

Wreck of the submarine "F-1" in Monterey Bay.

African forest hogs just acquired by the American Museum of Natural History.



Home-made gasoline ditcher.



Bridge built for the exclusive use of automobiles.

A Nickel-in-the-slot Bench

DROP a nickel in the slot and get a reserved seat for two; that is the idea of the new park bench in use in San José, California. The plan of the inventor is to place his bench in public resorts, parks, etc., not to do away with the free benches, but in addition to them. This will take care of the unusual Sunday and holiday crowds, who cannot find accommodation, and it will also appeal to people who wish an exclusive seat and do not care to rub elbows with strangers. Many people would gladly pay a nickel for this privilege, and the inventor expects to make enough on each bench to add to the revenues of the Park Commission, and pay him a modest profit besides.

As the photograph shows, the bench is so adjusted that it cannot be used until a coin is dropped in the box at the side. This releases a lock and the bench can be swung back, making a reclining or rocking seat if desired. It is also equipped with an awning, not shown in this picture. When vacated, the bench resumes its former position automatically, and locks, ready for the next patron.

A Home-made Gasoline Ditcher

THE accompanying illustration shows a novel home-made gasoline ditcher constructed at Fulda by a Minnesota farmer. The machine may be seen at work cutting a ditch one foot wide and six feet deep. The machine will dig to a depth of about 12 feet. Only one man is required to operate it. A 15 horse-power engine is used, supplying power to dig 8 to 12 rods per hour, depending upon the depth of ditch and soil. The grade of the ditch is obtained by a line stretched tight, and the gage rod from the main beam is kept on top of the cord.

Wild Honey in South Africa

MR. E. N. MARAIS has published in a South African agricultural journal a number of curious facts concerning the wild honey of the northern Transvaal. Two distinct kinds of honey are recognized, viz., the ordinary golden-yellow honey, common to all parts of the world, and a snowy white kind, known to the Boers as "sheep-tail fat honey." The latter is described as beautiful in appearance and of most delicious flavor, it is also reputed to possess valuable therapeutic qualities. When expressed from the comb it almost immediately assumes the consistency of vaseline. Its special qualities are said to be due to the fact that the bees extract it only from certain grasses. The hives are usually in hollow trees, sometimes in ant-bear holes or ant-hills.

Gathering wild honey appears to be a favorite pursuit of the Transvaal native, and one that has some peculiar features. The bee-hunters wear no protective clothing, but appear to be so thoroughly inoculated with formic acid as to be immune to its effects.

The favorite honey is produced by a stingless bee, called the "moka," of which there are two species. The larger of these builds only in the ground and in very hard soil. The hive is found at the bottom of a shaft having the diameter of a lead pencil, and from two to five feet deep. The honey is not stored in the comb, but in wax bags, each about as large as a good-sized thimble; these are cemented together with wax, forming a cluster about the size of an orange. A hive may contain from a few spoonfuls to two gallons of honey.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Some Old Key Rings

MANY interesting things are found among expired patents, especially when we touch upon an article in universal use. This is the case with key rings. Nearly every one carries a bunch of keys on a ring of some form. Possibly the form most generally used is the ordinary split ring in which several convolutions are lapped side by side. In the patented art we find many forms, some of which we show in the accompanying engravings. *A* is a key ring, probably devised by a musician, since it takes the general form of the clef, and in this ring the crossed wires and the middle ball bear upon the adjacent wires with sufficient force to hold a key when inserted as shown.

In *B* is shown a key ring of a novel form with a swinging latch which may be sprung over the end of the opened member to hold the ring closed.

C presents a form employing a linked chain and a fastening block for locking the chain closed.

D shows a form in which a flexible cable of braided wire is held at one end to a yoke, and is detachable at its other end so that it may be coupled up and uncoupled as desired.

E presents a triangular form with a sliding sleeve on one end, which may cross the gap or opening for the insertion and removal of the keys, and this sleeve has a tongue operating in a key way in the wire

The ring *F* has a swinging bridge which can close the gap between the ends of the ring.

The ring *G* is made of two semi-circular sections hinged together at one end and springing into interlocked engagement at their other ends.

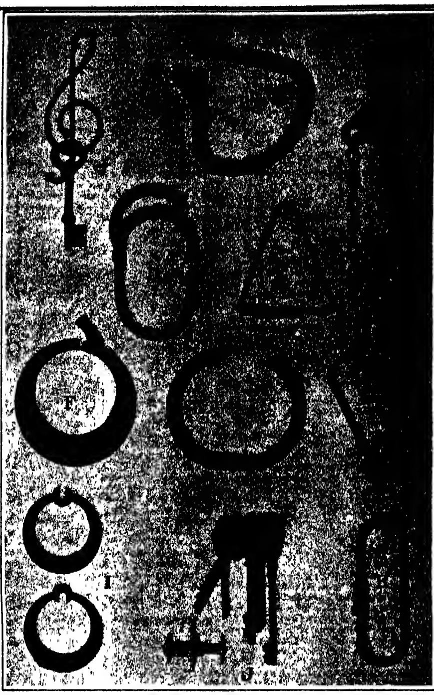
The ring *H* is of a special form, and has its separable ends formed one with a recess and the other with a tongue to spring into and out of the recess in connecting and disconnecting the ends of the ring

The ring shown at *I* will be recalled by many. When the revolving U-shaped part is in one position, the key may be inserted in the opening of such part and then turned to the position in which said opening faces the interior of the ring Thus the keys can be easily placed in and removed from the ring

J is a key holder without being a key ring, as in this construction a holding device is passed through the eyes of the keys so that they can turn independently upon the holder to bring any selected key into position for use

The ring *K* shows an interesting construction adapted for use as a key ring, and in which an open link has one of its ends threaded and a sleeve is threaded on such end so that it can be adjusted across the gap between the spaced apart ends to close the ring

All of the foregoing key rings are shown in expired patents. Some of the forms have been popular in some sections of the country; doubtless all have been used to a greater or less extent and they serve to illustrate the exercise of considerable ingenuity in the production of simple devices.



Some old key rings that have been the product of expired patents.

An Electric Safety Lamp for Miners

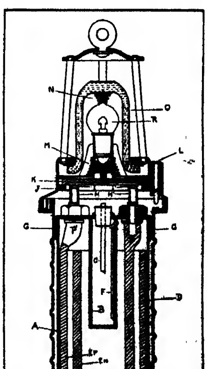
By Robert G. Skerrett

THE British government set an example some while ago when it offered a prize of $3,000 for an acceptable electric safety lamp for miners. A German engineer of the name of F. Faerber of Dortmund was the successful competitor In Europe, the annual loss of life due to mine explosions averages about one in every thousand operatives, while the yearly toll here is from four to five times as great.

The electric lamp is outwardly very similar to the benzine safety lamp, which is extensively employed in mines abroad, but there the similarity ceases. The benzine lamp is not absolutely proof against the menace of fire damp, while the "Cage" lamp is. The electric lamp is of 1.5 candle-power—having twice the illuminating value of its benzine rival—and is cheaper to maintain, costing but 1.25 cents per shift The capacity of the storage battery is extremely high, and for a lamp of 1.5 candle-power there is electric energy enough for an endurance of sixteen hours, or two shifts.

The Cage lamp consists primarily of an upper section holding the incandescent light and a lower one in which is housed the storage battery. The accumulator is of circular cross-section sealed inside of a celluloid casing. The form adopted for the battery elements is one calculated to withstand the rough treatment unavoidably incident to mining. Heretofore the elements have been in plates which had to be handled far too carefully to make their employment in a lamp of this sort practicable. By making use of cylindrical elements, Faerber not only obtains the desired rigidity, but he obviates the warping common to ordinary plates when they are overcharged or when too much discharged. Because of this characteristic, it is possible to charge the present battery to an exceptionally high capacity. This explains the endurance which is obtained.

A miner's electrical safety lamp that won a prize of $3,000.



Longitudinal section through the lamp.

In order to remove an exhausted cell, it is necessary only to cut through with a knife a band of celluloid paper which forms a seal. A new accumulator can be put in place in a very few moments without damaging the outer casing of celluloid which constitutes the housing for the cell. A new strip of this paper completes the installation again. Of course, it is very necessary that the lamp should not open inopportunely. To prevent this, a lock working upon the bayonet principle is provided, which is quite effective, having been previously thoroughly tested out in the old benzine safety lamps in service. To turn the current on or off, it is necessary only to rotate the top of the lamp through a small angle. By this means a contact is made and broken with connections rising from the bus-bars of the positive and negative elements.

The gases formed within the lamp are permitted to escape from the cell by following down a small tube *F*, which is contained within the cylinder *B*, and thence passing outward to the atmosphere by way of tube *C*. The arrangement is ingenious, and, as will be seen, effectually prevents the escape of the electrolyte should the lamp be upset or laid upon its side.

To guard the incandescent light from shock, it is virtually suspended or held in place between two opposing spiral springs. This installation is then inclosed within a thick glass cover. Metal stanchions and a rigid top further shield the glass from the accidents of ordinary service.

The general outward form of the lamp is free from any troublesome projections that might catch in the miner's dress or be easily knocked off by contact with surrounding objects. The exterior casing is of heavy corrugated tin drawn from a single piece, and, therefore, quite capable of standing pretty rough usage. The inventor has been continually mindful of the rather heedless character of the miner and of the rugged nature of the work expected of him, and the Cage lamp reflects this consideration in every department of its get-up. These lamps are already extensively employed in mines, both in the British Isles and in Germany, and it is said that they have given the utmost satisfaction in every particular.

Automatic Car Coupler

THERE has long been a demand for a car coupler that is absolutely automatic. To be sure, there are automatic couplers now in use, but it frequently happens that the couplers have to be alined manually to bring them in proper registration for automatic coupling. Difficulty has also been experienced in the operation of these couplers when one of the knuckles is in open position. Recently an inventor who hails from Strasburg, Virginia, has devised a car coupler in which the members are brought into mutual co-

operation or interlocking engagement even when both knuckles are closed at the time they approach each other. The design of this coupler is similar to that of the Janney type, but it has in addition a spring pressed plunger which renders the coupling automatic, and serves to retain the parts in locked condition when the cars are rounding a curve. The knuckles are also of hooked form and rounded inwardly, so as to guide the corresponding knuckle of the other member into engagement therewith. In a test of this coupler, it was found that it would operate when the cars were very gently shoved together, and that it would act either on a curve or on a straight line. It was also proved that it would pick up a runaway car, it only being necessary for the locomotive to follow at a greater speed than the runaway. The new coupler will operate satisfactorily with any of the standard types.

Notes for Inventors

Ozone as a Water Purifier.—In many European cities ozone works have been erected for sterilizing the drinking water and it is reported that satisfactory results are being obtained. Typhoid, cholera and dysentery bacteria are claimed to be destroyed by the ozonization process, and as the process may be used on a small scale, portable apparatus adapted for domestic use may offer a field for useful invention.

Cooling an Engine Independently of the Engine Speed.—In patent, No. 1,043,344, Yorgen Newman of Monroe, Utah, presents in connection with an internal combustion engine, a thermostatic device exposed to the heat of the engine, a fan driven by the engine to cool it and means to regulate the speed of the fan independently of the engine speed and including a connection between the regulating means and the thermostatic device, so that the speed of the fan will be varied independently of the speed of the engine and in correspondence with the temperature of the engine.

Life Preserver Within Bathing Suit.—John F. Burke of Philadelphia has obtained a patent, No. 1,041,012, in which is shown a bathing suit with a body garment within the bathing suit, comprising buoyant body portions and leg portions that are flexibly connected so that they will be held in place without the connections interfering with the movements of the wearer.

Walking Head Down.—A theatrical apparatus has been patented to John W. Frakes of Chicago, Ill., No. 1,040,303, in which a series of vacuum cups open at their bottoms are arranged in a row and controllable means are provided for exhausting air from the said cups and for admitting air to them, and the performer has plates secured to her feet and adapted to operate as closures for the cups, so that by properly manipulating the controlling devices the performer can walk head down along the row of cups.

An Improved Educational Device.—A patent has been granted for an educational device which includes a ring-like passageway and cross passageways within the ring and communicating at their ends with it, so that double faced buttons carrying letters or other characters may be shifted along the ring and thence into proper relation with the cross passages to spell words or for other purposes. The patent, No. 1,041,059, is issued to John H. Fox of Berea, Ohio.

A Westinghouse Company Electrical Distribution Patent.—Paul M. Lincoln, of Pittsburgh, assignor to Westinghouse Electric and Manufacturing Company, has patented, No. 1,039,767, a system of electrical distribution in which there is provided a number of line sections with means for supplying energy of different character to the respective sections. Normally deenergized intervening sections are arranged with respect to the energized sections and means are supplied for connecting the intervening sections to one or the other of the adjacent energized sections so that the vehicle may pass from the intervening deenergized sections.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the Scientific American.

Of Interest to Farmers.

CHICKEN FEED TROUGH.—G. H. Lee, 1115 Harney St., Omaha, Neb. The invention provides a trough for fowl and prevents them from scratching or wasting the feed; provides a trough guard which may be quickly adjusted therein after feed has been deposited to in this manner avoid interference with the loading of the trough; provides a trough and guard which coöperate to hold the guard in position; and provides a trough which facilitates the cleaning and sanitation of the same.

Of General Interest.

PROCESS OF TREATING THE CANDELILLA-PLANT FOR THE RECOVERY OF WAX.—W. S. Watson, Lock Box 1, Butler, Pa. An object here is to provide a process for treating the candelilla-plant in order to recover the wax and to leave the plant in such condition that it may be subsequently used for food. The invention provides a process for dry heating the plant and for subsequently treating the plant by dry steam, with a final treatment by water.

VIOLIN.—G. J. Junker, care of Wirs Bros., Greenville, Ill. This invention refers to stringed instruments of the viol type, such as violins, 'cellos, bass viols, etc. The object is to provide a violin arranged to produce a rich and deep tone, to permit fingering of the strings, and to maintain the strings in tune for a long period without retuning.

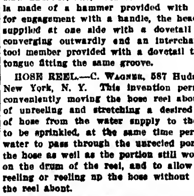
PART FOR WIGS AND THE LIKE.—M. R. Bonshkowsky, care of M. R Harris, Manhattan, 801 Southern Boulevard, New York, N. Y. In this patent the invention has reference to improvements in parts for wigs and the like, and has for an object the provision of an improved weave which will not disclose the supporting canvas or backing at any point, but will only show a groove or part in the hair.

FOLDING CAMERA CASE.—S. H. Peterson, 1825 Fifth Ave, Minneapolis, Minn. The invention in this instance relates generally to carrying cases for folding cameras and more particularly it involves a construction wherein it is not necessary to remove the camera from the case when it is desired to use the camera.

HOT WATER VESSEL.—S. W. Lonoan, 3735 Tracy Ave., Kansas City, Mo. This vessel is arranged with non-flexible flat, convex and concave surfaces, adapted to fit various parts of the human body and capable of giving off a graduated amount of heat, the vessel being arranged for use as an irrigator, by suspending the vessel and using the same as a tank connected with an irrigating tube to discharge the water under pressure onto a desired part of the body.

Hardware and Tools.

COMBINATION TOOL.—J. Staudes, 426 Locust St, Mount Vernon, N. Y. This tool, a sectional side elevation of which is shown in the engraving, is provided with interchangeable tool members to permit of readily converting the tool into or using it as a hammer,



COMBINATION TOOL.

claw hammer, ads, hatchet and the like. Use is made of a hammer provided with an eye for engagement with a handle, the head being supplied at one side with a dovetail groove converging outwardly and an interchangeable tool member provided with a dovetail tapering tongue fitting the same groove.

HOSE REEL.—C. Wagner, 587 Hudson St, New York, N. Y. This invention permits of conveniently moving the hose reel about, and of unreeling and stretching a desired length of hose from the water supply to the place to be sprinkled, at the same time permitting water to pass through the unreeled portion of the hose as well as the portion still wound up on the drum of the reel, and to allow of unreeling or reeling up the hose without moving the reel about.

CLASP.—F. Slover, Lindenhurst, L. I., N. Y. Mr. Slover's invention has for an object the provision of a means for holding parts of fabric together and in place by clamping the same so as not to injure or tear the fabric, yet to provide a means for readily unlocking the binding members of the same.

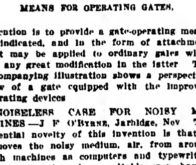
ATTACHMENT OF KNIFE BLADES TO THEIR HANDLES.—F. Hopps, Dawson, Neb. In this invention a permanent easily manufactured fastening of double tang into the handle takes place without aid of any further means of attachment such as cement or rivets, and is effected by making the part of the handle left between the perforations for the double tang greater than the space between the double tangs at the junction with the blade, so that the tangs when forced into the handle holes are forced apart and the terminal hooks on them are driven into the material of the handle.

Machines and Mechanical Devices.

ELEVATOR GATE CLOSING DEVICE.—E. L. Murray, 202 N 8th St., Council Bluffs, Iowa. This inventor provides a device for automatically closing the gates of an elevator shaft, whenever the elevator car leaves the floor in either direction, and set in operation by the elevator's movement, and so arranged that the car can not leave the floor without operating the means for closing the gate.

PIPE CUTTING MACHINE.—L. R Blackmore, 9 Small Ave, Caldwell, N J The object here is to provide a novel construction for driving the base or supporting rollers as well as for driving the cam for directly operating the cutter A novel means is provided for adjusting the operation of the cutter to suit the diameter of the pipe.

MEANS FOR OPERATING GATES.—C. W Witsil and F O. Williams, Anslomink, Pa. This road gate may be operated by the occupant of a vehicle upon approaching the gate, to cause the gate to move in a direction away from the vehicle, and whereby also when the vehicle has passed through the occupant can close the gate behind him An object of this



MEANS FOR OPERATING GATES.

invention is to provide a gate-operating means as indicated, and in the form of attachment that may be applied to ordinary gates without any great modification in the latter The accompanying illustration shows a perspective view of a gate equipped with the improved operating devices

NOISELESS CASE FOR NOISY MACHINES.—J F O'Byrne, Jarbidge, Nev The essential novelty of this invention is that it removes the noisy medium, air, from around such machines as computers and typewriters by incasing them in a suitable case, having means for operating the inclosed machine from without, and by a key operated valve connect the case, when closed, to a vacuum chamber which removes the air.

VARIABLE SPEED MECHANISM.—R M Buck, 44 Thurloe Square, South Kensington, London, England For the purpose of the invention the wheels of progressively varying diameter in the respective sets are arranged to form, in effect, toothed cones whose inclinations are opposed to one another, while the relative positions of the wheels of the two sets are such that only a single pair of change wheels can be in gear with one another at a time and that progressively varying speed-ratios may be obtained by shifting the slidable set of wheels through progressively varying distances lengthwise of its shaft so as to bring successive pairs of change-wheels into operation

Railways and Their Accessories.

EMERGENCY BRAKE SETTING DEVICE.—H S Beattie, 222 Poinsetta Place, Hollywood, Cal This automatic device is for use in setting the brakes on trains equipped with pneumatic brakes, which will operate to set the brakes when the car is subjected to any abnormal jolts or jars, as by the wheels leaving the tracks or by the breakage of one of the wheels of one of the trucks

CAR WHEEL SLIDE SHOE.—J. R. Flaming, 801 Monroe Ave., Scranton, Pa Among the principal objects in view here are to provide a sliding means for supporting the wheels and car connected therewith; to provide a shoe to bridge across frogs or other rail junctions on which the car is mounted; and to provide means for laterally adjusting the wheels to perform their ordinary function

FREIGHT CAR LADDER.—W. A. Mitchell, care of M. K. & T. R. R. Co., Sedalia, Mo. An object here is to provide ladders for the ends and sides of freight cars, which are in conformity with the U. S safety appliance law, and which possess features that render these ladders safer than the ordinary ones Roof grab irons obviate the use of screws or bolts in the roof itself

EMPLOYEE'S TRAIN TIME CARD.—E. J. Hardy, Caliente, Nev. Through the use of this card the movements of regular trains (passenger and freight), and extra or irregular trains are controlled without requiring a large amount of calculating work by the train dispatcher, and issuing, dispatching and repeating many worded or lengthy train orders, at the same time insuring a high degree of safety in running all trains

METAL DOOR.—L. G. Fowler and H V. Thomas, Blairstown, Mo The invention is an improvement in metal doors, especially adapted for railroad cars, wherein the door is provided with reinforcing ribs formed by bending the material of the door upon itself, together with the particular form of truss rod.

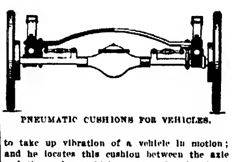
MEANS FOR VENTILATING RAILWAY AND OTHER CARRIAGES.—F Gain, 40 Rue de l'Arcade, Paris, France This device for use in ventilating carriages consists of a series of vertical glass strips mounted on pivots in a frame which is mounted in the wall of the carriage, these strips being connected by a coupling rod which enables them to be displaced all together

LUBRICATING DEVICE.—S Plymale, 720 Corbett St., Portland, Ore The principal object here is to provide a device adapted to lubricate the car wheel flanges, the device being moved into operative position by simple means within easy reach and control of a person in charge of the car as conductor or motorman.

Pertaining to Vehicles.

PNEUMATIC TIRE FOR VEHICLE WHEELS.—E R. Riedinger, 84 Upper Kennington Lane, London, S E., England. The tire comprises three concentric rims, the outer one of which carries a solid rubber tread band, while the inner rim is permanently attached to the felly of the wheel. Between the inner rim and the intermediate rim, is an air tube protected by a pair of elastic cheeks of rubber and canvas fabric Between the intermediate rim and the outer rim are annular clamping-plates secured by transverse bolts which exert a wedging action between the rims

PNEUMATIC CUSHION FOR VEHICLES.—J O Davis, R F D, No 4, Pawnee, Okla. The object here is to eliminate as far as possible, jolting and jarring as the vehicle passes over ground obstructions, without employing expensive pneumatic tires used on automobiles and other motor driven vehicles. The inventor utilizes a cushion preferably tubular in form,



PNEUMATIC CUSHIONS FOR VEHICLES.

to take up vibration of a vehicle in motion; and he locates this cushion between the axle and the springs which support the chassis of the car The springs used are carriage springs made up of a number of strips or leaves which are bent downward, and each spring carries midway of its length, at its lowest point, a shoe which rests upon a part of the tubular cushion The engraving shows a transverse section of the cushions as positioned on the rear axle

RESILIENT TIRE.—H. A. Stonham and C T Schwarze, 111 Sherman Place, S. Orange, N J This invention refers to a form of resilient tires for automobiles and other vehicles, and particularly relates to that type of resilient tires which are not intended to be inflated, and which are not only resilient, but are also reliable and durable

TIRE RIM.—J D Anderson, care of American Trust Co, Houston Tex The invention relates to tire rims for automobiles and similar vehicles, and an object is to provide a rim which will be of relatively light weight, strong, and which will remain securely in place Another object is to make a divisible rim in which each half is of the same size and strength.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each Please state the name of the patentee, title of the invention, and date of this paper.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Waste in Truck Tires

By J. M. Gilbert

FROM a constructive standpoint it is a fine industrial accomplishment so to build a solid rubber tire that it is in every way equipped to render a mileage service wholly commensurate with the dollars and cents investment of the user. On the other hand, it is quite another matter to have the structural strength and natural service-yielding qualities of the tire so conserved, through proper usage, that it will produce its full quota of mileage before being forced into premature deterioration through abuse and neglect.

In promoting an economic tire service the scope of the tire manufacturer has pronounced limitations. When once his product passes into the hands of the consumer, systematic co-operation is necessary to secure the result sought after—the greatest possible mileage at the lowest possible cost.

As a matter of fact, there is a tremendous waste in truck tires. Some of this waste is due to ignorance on the part of truck operators. However, much more of it can be traced to lax methods, shortsightedness and downright abuse. Many drivers apparently entertain the misplaced idea that solid tires require no looking after so long as they remain on the wheels and run. They seem to reason, further, that inasmuch as they are protected by the manufacturer's guarantee, the treatment they give their tires has little or no direct determining value upon their tire maintenance cost. This is an absolutely fallacious conclusion.

Mileage and Cost.

A manufacturer's guarantee of mileage, whether it be for 6,000, 8,000 or 10,000 miles, has little or no effect, ultimately, in fixing tire costs beyond establishing a maximum cost. That is to say, if a manufacturer guarantees his tires for 8,000 miles and by careful driving and the proper handling of them the owner gets 10,000 or 12,000 miles of service, he has reduced the operating expenses of his truck to the extent of the extra mileage his tires have yielded. In such cases the operator, himself, has been directly responsible for fixing a minimum of tire cost, irrespective of anything the manufacturer may have promised him in advance.

Furthermore, the manufacturer does not say to the user that his tires are guaranteed for a certain mileage regardless of the uses and abuses to which they are put. So here is another very logical reason why it is profitable to give tires the attention they deserve, not only because of their inestimable importance in truck equipment, but because they are expensive as well.

Overloaded Tires.

Truck operators who do not safeguard their tires against the common forms of abuse which shorten tire life, are bound to find their bills for up-keep far in excess of what they should be. There are a few profitable "don'ts" which should be posted conspicuously in every garage. Some of them follow:

Don't overload your tires. Bear in mind that they must sustain every ounce of weight above them. When overloaded a greater burden is imposed than the manufacturer designed them to carry. The result is they break down prematurely, disintegrate and do not yield anywhere near the mileage they are capable of.

Carrying Capacity.

The following table shows the average carrying capacity, per tire, of the various common sizes of solid tires, single and dual:

Sizes from		Single. Pounds.	Dual. Pounds.
30 x 2½	to 42 x 2½	650	1,400
30 x 3	to 42 x 3	950	2,500
30 x 3½	to 42 x 3½	1,375	3,500
30 x 4	to 42 x 4	1,750	5,000
34 x 5	to 42 x 5	2,000	6,000
36 x 6	to 42 x 6	3,000	8,000
36 x 7	to 42 x 7	4,000	10,000

Determining the Load.

It is an easy matter to determine whether a truck is sufficiently tired to carry its load. Run it on the scales and get the total weight. Then back off the rear wheels, leaving the front wheels as near the center of the scales as possible. Record this weight and deduct it from the total. This gives you the load the rear wheels are carrying. Supposing the combined weight of the truck and load is 13,000 pounds, distributed 3,000 pounds front and 10,000 pounds rear, this truck requires four-inch single tires in front and four-inch dual tires in the rear. If the truck is not equipped up to this standard you may be sure it is under-tired and that an overload is being carried.

Care of the Tire.

Excessive speed is incalculably hard on tires. When a truck is bumped recklessly along at an immoderate pace the strain on the tires is terrific and they soon go to pieces.

Care should be exercised in stopping and starting. Sudden and violent action has a tendency to separate the tread of a tire from its base.

A truck should not be left standing over night under load. To do so imposes an unnecessary strain on the tires.

Oil is a natural enemy of rubber and tires should never be allowed to rest on a greasy garage floor.

A little sound reflection on the tire question is sure to prove a profitable investment of time for any truck operator.

Give it a trial and see if this statement isn't true.

The Motor Truck's Span of Life

By John R. Eustis

IN computing the cost of operating and maintaining motor trucks, it is customary to include depreciation as one of the items. This item varies from ten per cent or twelve per cent to as high as thirty-three per cent of the purchase price of the vehicle, the higher percentage prevailing a few years ago and the lower percentage being the rule now-a-days. In other words the life of the motor truck is estimated at from three to ten years.

Depreciation Charges.

The practice of including depreciation among the items of expense is undoubtedly a continuance of a similar practice in connection with horses, for it must be understood that most of the motor trucks used are doing work formerly done by horses and in the service of the same owners. Many years of experience with work-horses taught the obvious lesson that a horse costs so much in the beginning, so much each year for feed, shoeing, veterinary service, etc., and at the end of a certain period of time, dies, then becoming a total loss, except for the few dollars its hide will bring. The United States Department of Agriculture has compiled and published statistics which prove that the average working life of a horse in this country is five years, and in the larger cities a little more than four years. It is, therefore, entirely justifiable to allow from twenty to twenty-five per cent on the purchase price of a horse each year under the head of depreciation.

In continuing this practice when motor trucks are substituted for horses, an injustice is done to the former. This injustice lies not in the fact that the depreciation charge each year increases the yearly cost of operating and maintaining motor trucks, for the latter have been able to show satisfactory economy, even where the depreciation charge was high, but in that it sets the limit of a motor truck's life at a few years.

Horses Cannot be Repaired.

Under the customary methods of computing the cost of operating and maintaining motor trucks, all repairs and replacements are also charged. Under these two heads, the expense of keeping motor trucks in good running condition is provided for, and if all necessary replacements have been made, then at the end of a number of years of service the owner has a vehicle capable of doing the same work that it did when new; yet it might be that at the end of ten, twenty or thirty years, not one part which was in the original vehicle remains. This, then, is the real difference between horses and motor truck as far as their span of life is concerned, and it would seem not altogether incorrect to say that the motor truck's span of life is everlasting.

The proof of the pudding is of course in the eating, and the life of a motor truck can best be estimated from actual experience. Unfortunately, however, the commercial motor vehicle is of such recent origin that a number of years must elapse before the theory in this case can be substantiated by actual practice. There are, however, a number of motor trucks of various types which have been in constant service in this country for from five to ten years, and most of them can do as much work to-day as when new. Furthermore, the present day vehicles are vastly superior to those manufactured between 1902 and 1907.

A Department Store Experience.

A large department store in London is operating twenty-two motor vehicles, which have traveled a total of 1,110,000 miles, or an average of 50,000 miles for each vehicle. One of these vehicles has averaged close to 12,000 miles per year for eight years, and its owners state that it is giving just as good service to-day as it did at the beginning. If there is a limit to the life of a motor truck, it has not as yet been determined.

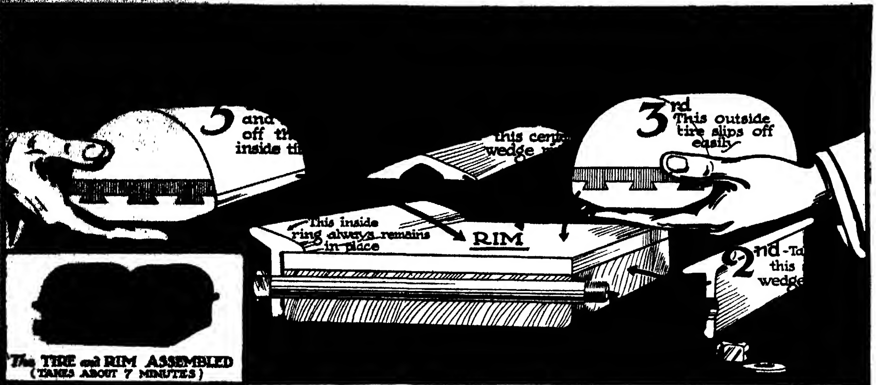
Motor Truck Queries and Answers

A. W. R. writes: I have noted statements to the effect that the block tire for motor trucks, because each block is surrounded by air, keeps much cooler in service than the continuous solid tire. I will appreciate any information on this matter that you can give me.

A. While we have no exact data on the block tire, we know that under exceedingly heavy loads they give a better performance than the continuous tires; for instance, in coal trucks and the like. Theoretically the block tire does not generate the heat that the continuous tire does because it has more radiating surface, and because the rubber has an opportunity to displace more easily. Furthermore, in blocks there is no accumulated wave, such as there necessarily is in an endless tire, the lack of which wave cuts out strain at the base of the tire, and also increases the mileage, as the weakest part of the solid tire is the joint between the base and the tread rubber.

M. R. S. writes: Is the steam motor truck a possible factor in this country, and is it not the logical type for very heavy work?

A. Outside of the British Isles, the steam truck is hardly known to-day, and there it is giving way to the gasoline vehicle. As for heavy work both the steam tractor and the steam road roller are rapidly being supplanted by those [illegible] gasoline engines, so there does not [illegible] much [illegible]



Here is a tire that has created a veritable sensation in the motor truck world—a tire that is mechanically correct in every detail, and that will permit of a complete tire change in fifteen minutes' time.

Your driver becomes your tire repairman when you equip your truck with this tire.

A hammer, a wrench and his two hands will be his complete repair shop equipment.

A tire change will mean a few moments' work in your own garage after working hours instead of a truck laid up for days at a time while a wheel is away at some distant tire repair station.

Figure for yourself what this protection against the tying up of your trucks will mean to you in the course of a year.

Futhermore, United States Standard Tires bear an absolute guarantee that makes them extremely economical tires to use from the standpoint of mileage. They are:

ABSOLUTELY GUARANTEED FOR 10,000 MILES OF SERVICE

conditional upon its being used within one year's time

UNITED STATES TIRE COMPANY · NEW YORK

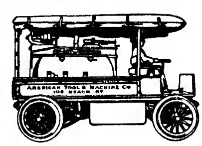
Special Notice:

"War!" cried the American people. The President of the United States, a hebrew of refinement said "No." He was impeached he defended himself, and his telling of it rings out in the December American Magazine. Now on sale everywhere

39 G. V. Electric Trucks For the Philippines

The U. S. War Department, Manilla, uses 19 G. V. Electrics for hauling distilled water, ice and stores. Should you send your soldier nephew a Christmas present "ten to one" a G. V. Truck will deliver it.

We have 4 G. V. Trucks in other service there and this week we received an order for 16 more, making 39 for Manilla and nearby towns. Several will be used in department store service. We have 14 in Rio de Janeiro.



Here is a 1-ton G. V. Truck which has been in service over six years. It received no special care—in fact, the body was not painted for the first five years. At the end of five and one half years the wagon was thoroughly overhauled and because this unusual course had become imperative, the charges against the truck were computed for the first time. They came to $1509.00 for the five and one half years.

This $1509.00 included all maintenance charges, including renewals of parts and batteries.

Wouldn't you like to know more about G. V. Electrics? Catalogue 101 on request.

The General Vehicle Co., Inc.

***Principal Office and Factory,* LONG ISLAND CITY, N. Y.**

New York Chicago Boston Philadelphia St. Louis

Asphalt Still a Mysterious Material

(Concluded from page [illegible])

itself had more of a quasi-scientific interest rather than a practical one, and not until the nineteenth century was any industry again based upon it or the application of it revived. At the present time, however, it is considered to be the best street paving material available.

The ancients gathered their asphalt from the Red Sea, which to this day produces a minor quantity, but the largest portion of the world's supply comes from Trinidad, Venezuela and Cuba. Trinidad asphalt, although at first used as a substitute for coal tar, and an improvement on it in roofing and like purposes, is the substance now generally used in the United States for street paving, and of the fifty millions or more of square yards laid in the country, it is estimated that at least seventy-five per cent of this is a mixture in which Trinidad asphalt forms a part. The deposits of the pitch lake in Trinidad occupies a bowlike depression of about a hundred and fifteen acres, which is probably the center of an extinct volcano. The center of the lake is not quite a mile from the Gulf of Paria and is about one hundred and thirty-five feet above the level of the sea, and its contents are of remarkable uniformity, and its surface is in constant motion, there appearing at times what may be termed currents and eddies. The middle of this wonderful lake is about one foot higher than the edges, this relation being maintained, although the body as a whole has been lowered by the constant removal of material. There is an overflow from the lake to the sea through a crevice in the rim, and this stream is from 15 to 18 feet deep, but beneath this stream is a ravine still filled with asphalt, which seems to have no limit to it. The asphalt that comes from Trinidad is too brittle for direct use on the streets, and must, therefore, be mixed with other material before it is finally used for paving. The depth of the lake at Trinidad is supposed to be about one hundred feet, although the actual bottom of the crater-like depression has never been reached. The pitch itself can be picked up and molded without soiling the hand; but one of the most peculiar characteristics of this strange body is that the deposit renews itself almost as soon as it is removed.

The asphalt lake in Venezuela is situated across the Gulf of Paria about 105 miles due west of the Trinidad lake. This body covers an area of about one thousand acres, being nearly nine times as large as that of the lake at Trinidad, however its deposits are only a few feet deep in some places. So not only is the supply from Venezuela not nearly so great as that of Trinidad, but it differs from it, as it is not always uniform and at times is softer, but notwithstanding this difference in quality some scientists claim that the two lakes are geologically connected. Cuban asphalt comes from various parts of the island, and in one location, the Bay of Cardenas, it is actually drawn up from the bed of the bay itself, through eight or nine feet of water. The surface of an asphalt lake, except for small wooded islands, is bare of vegetation and hard enough to bear foot traffic or even carts in the cool of the morning, while by the aid of a sort of corduroy road made of palm branches it supports a cable tramway. The work of mining asphalt is suspended during midday as the stuff becomes to hot to work with; in fact, an asphalt lake is said to be the hottest place on earth.

Geographic distribution of asphalt or its allied bitumens is a well-classified phenomenon, although new sources have been discovered from time to time, the search for coal and petroleum often revealing a hitherto unknown bed in an unsuspected part of the earth. In Egypt deposits of a very pure asphalt occur and have perhaps been known since the beginning of history, and from an immemorial period asphalt has been cast up by the Dead Sea which, at times, has been exploited commercially. In Asia Minor, Persia, and the valleys of the [illegible]

rivers valuable deposits are also found. Solid bitumens are found in many places in the United States, along the Connecticut River, in New York State, in New Jersey, and in West Virginia. Beds of the material exist in Texas, and veins have been discovered in Utah, Colorado, Missouri, Kentucky and in California, those in the last named State and in Texas being the most important. The advent of the motor car has caused asphaltic streets to become more and more popular the world over, and with the improvement in preparation, together with the cheapening of the product as larger supplies from new deposits become known, even cities in the Far South can now depend upon the firmness and economy of asphalt for street paving.

The Heavens in December

(*Concluded from page 4?.*)

past opposition, and is a splendid object in the evening sky, appearing fully equal to Capella in brightness. His rings are now apparently opened at a wide angle, and he well repays telescopic study, even with a very small instrument.

Uranus is in Capricornus, too low in the west to be observed, even early in the evening.

Neptune is in Gemini, as illustrated on our chart.

The Moon is in her last quarter at 4 A. M. on the 1st, new at 10 A. M. on the 8th, in her first quarter at 1 P. M. on the 16th, full at 10 P. M. on the 23d, and in her first quarter again at 1 P. M. on the 30th. She is nearest us on the 25th, and farthest away on the 14th. In her circuit of the sky she passes near Mars on the 7th, Mercury on the 8th, Jupiter on the 9th, Venus on the 11th, Uranus on the 12th, Saturn on the 21st, and Neptune on the 25th.

At 11 A. M. on the 21st the Sun reaches its greatest southern declination, and in almanac parlance, "winter commences;" while at 8 P. M. on the 31st the Earth passes through that point in its orbit which is nearest the Sun.

Princeton University Observatory.

Public Support of the Aeroplane Fleet in France

THE following data have been issued concerning the funds collected by public subscription for the French aeroplane fleet and also the credits voted by Parliament for the same purpose For the budget of 1912, Parliament voted the sum of $1,500,000, to which is to be added the funds raised by subscription, or $348,000, making a total of $1,848,000. This sum has been employed as follows: Aeroplanes ordered and paid before October 1st, 272; orders pending from now until the end of the year, 90 aeroplanes. This will give a total of 362 aeroplanes purchased with the above amounts during 1912.

As concerns the purchase of aeroplanes by the French army, the authorities have made an interesting decision lately. Starting from October 1st, a new commission will carry out this work, and its object is to decide upon the number of aeroplanes to be purchased according to available funds. It is composed of Colonels Bouttieaux, Etienne and Breton, chiefs of aeronautic centers. It will hold meetings twice a year and make out the order lists for the next six months so as to bring about a regular production and not overcrowd the factories. The formerly existing aeroplane commission will now be limited to examining the specifications and reception of aeroplanes. In short, the first commission is occupied with the number of machines and the second with their quality. By next year the army expects to have three types of aeroplanes in use, a very rapid machine for single pilot which can readily be displaced, then two-place machines for scouting trips of some length, besides armored aeroplanes provided with guns.

ACCORDING to the *London and China Telegraph* a project is on foot to build a railway on the wall surrounding the city of Peking.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12708) V. F. S. asks: Will it ever occur that the four planets in order of distance from the earth i e., Venus, Mars Jupiter and Saturn, assemble in our western sky one or two hours after sunset together with our inseparable moon? I am not an expert in astronomy, but such display does not seem to be impossible, as I well remember when in my teens having once viewed Venus, Jupiter, and Saturn, the three planets not very far from the moon six or eight days old A. An astronomer can trace a planet backward or forward and find when it has been or will be in a certain position with reference to the sun and earth, and also when any number of other planets will be in the same position. At some time the four planets which you name will be in the western sky together with the moon The same conjunction will recur at regular intervals, as it has done in the past The interval will be the least common multiple of the intervals required by each of these planets to come to this position

(12709) J. W. S. asks: I have lately been reading in a newspaper a long account of a "rainmaker" or in other words of a man who is supposed to be able to produce rain in any part of the world at any time, indeed, according to the article (it is not an "ad") he has never been known to fail Can you through the medium of your paper, tell me whether there is any truth in this statement, or whether it is mere romancing? A. We have no reason to doubt that the gentleman whom you name in your letter of inquiry is a reality, and that he is in the business of "rain-making." That he can actually cause a rainfall is quite another matter We do not believe that The United States Weather Bureau has many times given its opinion that the production of rain at a time when it would not otherwise have fallen cannot be brought about by any means in the power of man The enormous weight of air in a storm cloud of even moderate extent prevents our believing that a discharge of powder or dynamite can affect the cloud Even if a great shock could be given to the air, there is no reason to believe that a shock can condense water vapor to water drops, producing a cloud in clear air and causing a downfall of rain from the cloud thus formed Water vapor is not condensed into water by a shock It is condensed by cooling The popular notion that rain is caused by great battles or other explosions is regarded by scientific men as entirely erroneous In reference to this matter, Prof Moore, Chief of the United States Weather Bureau, recently wrote to one of our papers He said "If such attempts held out the slightest prospect of success, the Weather Bureau would give them every encouragement Moreover, if rain-making were merely a harmless popular delusion, this bureau would not feel called upon to take an active part in opposing it This, however, is far from being the case The advocates of rain-making, whether acting in good faith or from some selfish motive, have already been responsible for the waste of a great deal of money on the part of the public, and at present a deliberate propaganda appears to be in progress in behalf of these extravagant and absurd undertakings" This would appear to be a sufficiently positive opinion by the man most likely to be informed

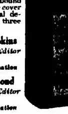
(12710) C de S. says: 1 It is claimed that a mixture consisting of 1 cubic meter oxygen with ¾ cubic meter acetylene will, when burnt, produce a heat of 3 600 deg Cent Is this correct? A The temperature of the oxy-acetylene flame is given as 3,500 deg Cent The combustion of a cubic meter produces 13,558 calories. 2. Of how much oxygen and acetylene (the acetylene being of the quality as generally used for autogene soldering) should the mixture consist in order to produce a heat of 1,600 deg Cent? A The quantity burned does not affect the temperature of the flame, if the combustion is complete. A small flame has very nearly the same temperature as a large one Imperfect combustion would reduce the temperature of the flame, but we could not give any rule for producing a temperature of 1,600 deg Cent 3 How many heat units or calories are developed by *one gramme* of oxygen and acetylene, and of how much oxygen and acetylene respectively does this one gramme consist? A We have not the data at hand for determining the calories produced by the burning of one gramme of acetylene and oxygen mixed in the proper proportions for complete combustion. The value of a cubic meter of acetylene in calories as we gave it above is the ordinary way of stating the question 4 The SCIENTIFIC AMERICAN of August 3rd, 1912, brings interesting information regarding the electrical production of pig iron. It would be very interesting to know the *cost per kilowatt hour*, also, which those trials at Trollhatten established This cost will, of course, be different at different places, but would, nevertheless, serve as a valuable basis for us, and I would therefore be grateful if you would kindly inform me these costs also. A We have no report which gives us the cost of electric power at Trollhatten, but you can doubtless obtain the figures from the Swedish consul at your place or by writing direct to Trollhatten, Sweden.

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

JUST PUBLISHED

Scientific American Reference Book

EDITION OF 1913



It contains 608 pages and 1000 illustrations, is substantially bound in cloth and the cover carries a special design printed in three colors

Albert A. Hopkins
Compiler and Editor for Part I
Statistical Information

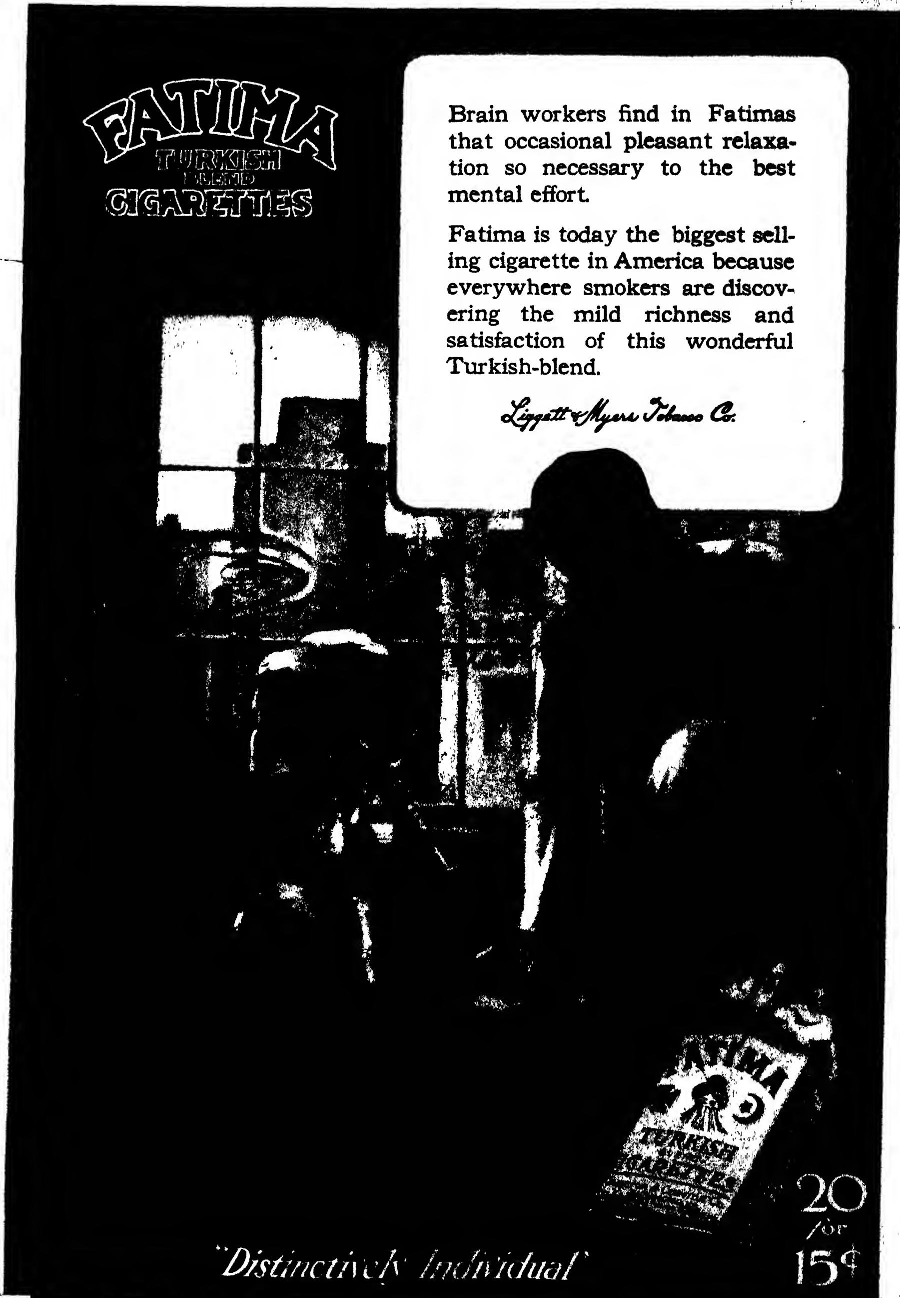
A. Russell Bond
Compiler and Editor for Part II
Scientific Information

In order to supply knowledge in concrete and usable form, two of the Editors of the Scientific American have, with the assistance of trained statisticians, produced a *remarkable Reference Book*, containing over seventy-five thousand facts, and illustrated by one thousand engravings, for which the entire world has been scoured. Immense masses of government material have been digested with painstaking care with the collaboration of government officials of the highest rank, including cabinet officers.

An elaborate circular, showing specimens of illustrations, together with four full-size sample pages, will be sent on request.

Net Price $1.50 Postpaid

MUNN & CO., Inc.
Publishers
361 Broadway New York City

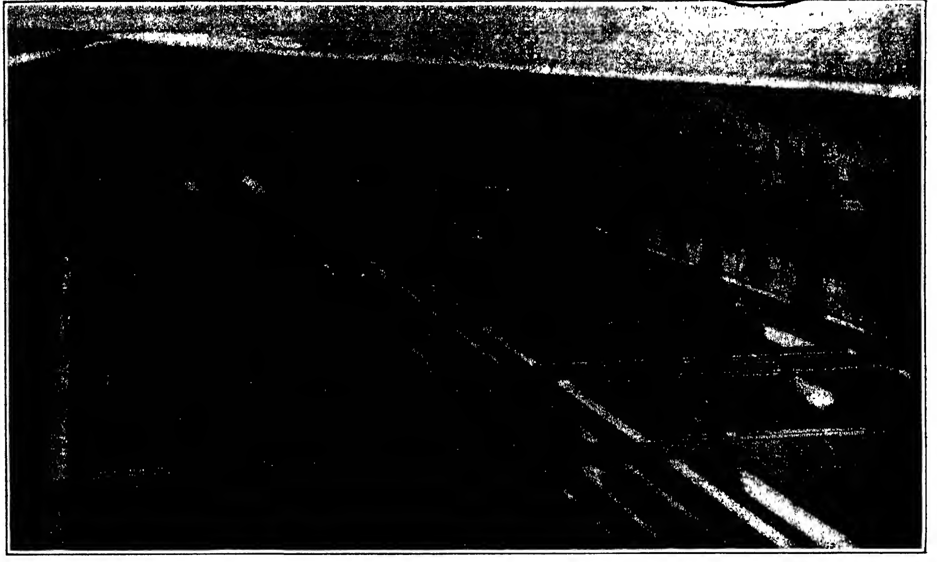

FATIMA
TURKISH BLEND
CIGARETTES
Brain workers find in Fatimas that occasional pleasant relaxation so necessary to the best mental effort.
Fatima is today the biggest selling cigarette in America because everywhere smokers are discovering the mild richness and satisfaction of this wonderful Turkish-blend.
Liggett & Myers Tobacco Co.
FATIMA
"Distinctively Individual"
20 for 15¢

SIXTY-EIGHTH YEAR

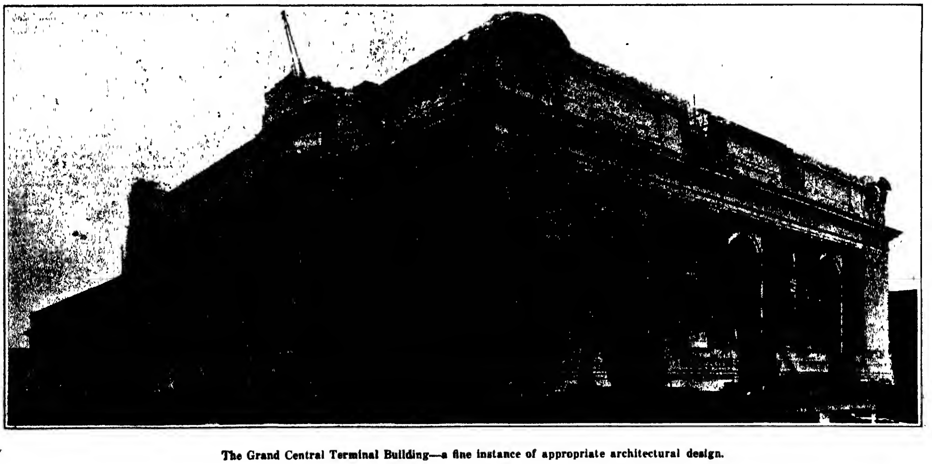
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 23.] NEW YORK, DECEMBER 7, 1912. [5 CENTS A COPY $3.00 A YEAR



The terminal yard and buildings, showing the express level, with Park Avenue and the cross streets restored to city use, and blocks available for erection of business buildings.



The Grand Central Terminal Building—a fine instance of appropriate architectural design.

A MONUMENTAL GATEWAY TO A GREAT CITY.—[See page 484.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, DECEMBER 7, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N.Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year . . . . Postage prepaid in United States and possessions Mexico, Cuba, and Panama	$3.00
Subscriptions for Foreign Countries, one year, postage prepaid.	4.50
Subscriptions for Canada, one year, postage prepaid.	3.75

The Scientific American Publications

Scientific American (established 1845) . . . . per year.	$3.00
Scientific American Supplement (established 1876) . "	5.00
American Homes and Gardens . . . . "	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Gratifying Conditions in the Navy

A CAREFUL reading of the annual report of the Secretary of the Navy will satisfy every impartial mind that things are going well in this important department. This journal has watched the development of Mr. Meyer's administration with a critical but always friendly eye; and although, at the outset of his control, we felt called upon to criticise certain of the changes which he introduced, we are frank to admit that the results achieved during the past four years, entitle his administration to be considered one of the most successful in the history of the department. Altogether pardonable is the evident pride with which, in this report, Mr. Meyer refers to the mobilization of the Atlantic Fleet, which took place in the North River, New York, during the autumn of the present year. The gathering together in orderly review and at so short notice of a fleet of 123 ships aggregating 720,480 tons, tells the story of preparedness and efficiency. We trust that this review, because of its powerful educative and stimulating effect upon the people of the United States, will become an annual institution.

The Secretary opens his report with a plea for making permanent by legislation his system of naval aides, whose duties are to advise the Secretary on complex questions calling for technical knowledge. Three years' experience convinces Mr. Meyer that the efficient administration of the Navy cannot be accomplished by a Secretary, unless he is assisted by a board or council made up of technical advisers. The aides meet in full council daily, and they meet the Secretary at least once a week. Congress should now give to this arrangement its legal sanction. It is recommended that in order that the Navy may get the highest possible efficiency and preparedness for war, a council of National Defense be arranged, which will in a way be a vehicle between the Navy Department and Congress. It is suggested that the council be made up of two cabinet officers, four senators, four congressmen, two army officers and two navy officers.

The preparedness of the fleet as regards repairs and upkeep has been maintained at a most satisfactory standard, and the ships have been generally in a condition during the year to respond to the many calls that have been made upon them. This has been due to the development of a spirit of self-dependence, every ship being made self-sustaining as far as possible; the establishing of routine docking and repairs; the standardizing of major changes and alterations; the use of fleet auxiliaries; and improvements in yard methods. In 1912 there were 160 ships in active service or ready for service, as against twenty on the repair list—an excellent showing.

The General Board of the Navy recommends an increase of the Navy at the coming session of Congress by the addition of four battleships, two battle cruisers, sixteen destroyers, six submarines, a dry dock and a submarine testing dock, two transports, one ammunition ship and one supply ship. It is pointed out that the four battleships will simply replace four existing battleships which will be twenty years old in 1914 and must then be withdrawn. While battle-cruisers are recommended, the Board thinks that they should not be built at the expense of the battleship programme, the paramount need of the navy being for more battleships. The Navy certainly needs the transports that are asked for; we are astonished to learn that the "Prairie" and the "Buffalo," the only vessels at present available for such duty, are both over twenty years old, and that "both are single-bottom ships, and entirely lacking in water-tight subdivision, having been originally designed as freighters." It is simply murderous, in view of what happened to the "Titanic," to be using as naval transports, old ships that would be doomed if they experienced a serious collision.

As regards the engineering competitions, we are glad to learn that the performance of the vessels, almost without exception, has been highly creditable both as regards speed and economy. The larger vessels, we are told, either exceed or fall slightly below their contract speed, which in view of their increasing age indicates a high state of efficiency and continued attention to detail. The new destroyers, almost without exception, duplicate and frequently exceed the speed made at the time of their delivery to the Government. In the matter of smoke prevention, oil-burning destroyers have constantly improved, and the entire fleet can now steam at high speed without any smoke whatever, a fact of which the writer has been witness when present with the torpedo fleet.

Our powder is entirely satisfactory. The fact that the nitro-cellulose powder used in our Navy is broadly similar to that which destroyed the French battleship "Liberte" need cause no uneasiness. The French methods of manufacture are greatly inferior to our own; and our regulations for stowage, inspection, etc., are comprehensive and very strictly observed. Since the adoption of the present type not one accident due to decomposition or spontaneous ignition has occurred—no other service has such a record.

The present subdivision of work in the Navy Yards into a hull division and a machinery division, we are told, has been eminently satisfactory. This is proved by the efficiency and economy with which repairs are undertaken and completed. Mr. Meyer impresses the necessity for securing a spirited co-ordination in the administration of the Navy Yards. He approves of the recommendation made by the joint Army and Navy Board, that there should be two great naval bases on the Atlantic coast, in harbors which could receive and maintain the entire fleet and its auxiliaries. In keeping with the Department's policy of concentration, the naval stations at Pensacola, New Orleans, San Juan, Culebra and Sitka have been closed.

An urgent plea is made by Mr. Meyer for the creation of the admirals and vice-admirals which are necessary for a properly administered fleet. No provision is now made for any except the lowest grade in rank, namely, that of rear-admiral; whereas the recognized grades are admiral of the fleet, admiral, vice-admiral and rear-admiral. A battle fleet should be commanded by an admiral, vice-admirals should command squadrons; rear-admirals should command divisions. We have more vessels in commission than most of the nations giving higher rank to their officers; yet when our fleet enters foreign waters, our naval officers are compelled to yield precedence to ranking officers of the smaller nations. It is not a question of our naval officers as individuals being placed in inferior positions when they meet the fleets of other nations, but rather it is that in the eyes of other nations we put ourselves in the position of an inferior.

Fixing the Price of Patented Articles

FOR the sole purpose of encouraging the arts, the Constitution of these United States grants to a patentee the right to dictate the conditions under which his invention may be manufactured, used and sold, a right which may be exercised only during the life of the patent. Extensive though his privileges may be, we have still to hear of any flagrant instance in which the patentee has abused them. Indeed, he could not if he would. The public, not being deprived of anything that it ever enjoyed before the patent was granted, would refuse to buy patented articles which may be obtained only by observing conditions too onerous and which it can well do without. Good merchandising demands that the patented article be sold at the lowest possible price in order that the widest possible public may be reached. In recent years there has been an increasing tendency on the part of manufacturers to take advantage of the constitutional right of fixing the price at which a patented article may be sold. The result has been exactly that contemplated by the framers of the Constitution—the encouragement of new industries and the general distribution among the public of new, useful and inexpensive inventions that have made commercial and domestic life more attractive than ever.

One of the provisions of the amended Oldfield Bill seeks to destroy this time-honored right of the patentee, despite testimony from the foremost manufacturers to the effect that the fixing of selling prices on patented products have redounded to the benefit both of the manufacturer and the public. The representatives of companies whose patented wares are advertised the world over at a fixed price unhesitatingly revealed their factory methods, frankly laid bare their relations to jobbers and retailers, and freely gave exact figures of manufacturing costs and retail selling prices. A careful reading of their testimony has not brought to light a single instance in which the profit made under the price-fixing system by manufacturer, jobber or retailer is exorbitant. Indeed, we have been struck with the meticulous care that has been taken to prevent overcharging. It seems to be axiomatic that the higher the price to the ultimate consumer, the fewer must be the buyers of the manufactured article. Price-fixing, therefore, is a distinct blessing; it always means a good article sold at a price so low that almost every one can afford to buy it.

Something of the old craftsman's pride in the quality of his work seems to enter into the making of patented articles—at least that impression is left by the testimony of a dozen able manufacturers. Pains are taken to select only sound raw material; the workmanship must be the best; the package must be substantial, neat, and inviting.

The psychological effect of such good manufacturing principles and sound selling methods is inestimable. Confidence is inspired in the manufacturer and in the patented article itself. Hardly has this result been obtained, at the cost of years of effort and perhaps millions in money, when the parasite appears—the dealer who contributes nothing to an art and who battens on the energy of others. In his catalogues and advertisements he announces the sale of patented articles, made popular by much advertising, at prices less than those fixed by the manufacturer. He violates the restrictions imposed upon him, although he knows that ultimately he will be brought to book by legal proceedings. The psychological effect of his trickery is just as marked as that produced by good manufacturing and selling methods. If this patented thing, sold elsewhere for never less than three dollars, can be bought for two dollars and sixty-eight cents, does it not follow that all the other less familiar unpatented articles listed in the catalogue or advertisement can also be bought at prices lower than those charged ordinarily? Only by making the experiment does the purchaser discover that his reasoning is wrong; that he has been duped; that he has been made to pay an extortionate profit for a poorly made unpatented thing, because the patented goods of standard quality were sold below the standard price. Is it any wonder that the small retailer will refuse to deal in patented articles, the price of which has been fixed, if a larger dealer, who can afford to lose money on one patented sewing machine, for the purpose of making a profit on a thousand unpatented tables, chairs, flower pots and hats, is permitted to undersell him? Is it any wonder that for the retailer's sake and for the sake of the public, and consequently for their own sakes, manufacturers enforce their price restrictions under the patent law?

It may be, as some contend, that the framers of the Constitution never contemplated the extension of a patentee's rights so far that he can follow his article into the hands of the ultimate consumer. But it may also be contended with more force that the framers of the Constitution never contemplated the restriction of a business that is based primarily on the confidence of the public in a patentee and in the thing that he has invented.

High Speed and Good Rails

IN view of the present unsatisfactory condition of the rail question in America, the average rail which is being placed in our tracks not being able to stand up with any certainty under heavy, fast traffic, the recent decision of the New York Central and the Pennsylvania Railroads to reduce the speed of their eighteen-hour trains to Chicago is commendable. At the same time, it is a step backward. Time is becoming so increasingly valuable in the industrial and commercial world that the demand of the public for high speed, both on sea and land, is justified. Great credit was given to these two railroads when they instituted the eighteen-hour schedule from New York to Chicago; and had the rail manufacturers kept pace with the progress of the railroads, it would not now be necessary to reduce the running time of these two famous trains.

This reduction in train speed, following the recent recommendation of the governmental authorities, will have the good effect of emphasizing the urgent need which exists for the manufacture of absolutely sound rails. That such rails can be produced is proved by the fact that they are now being rolled and are giving satisfactory service under heavy fast traffic in Europe. Both in England and in Germany it has been found that by giving careful attention to the composition of steel and the method of casting it into ingots, it is possible practically to eliminate both segregations and piping. The processes, it is true, call for some slowing up of the manufacture; and this was to be expected. Their introduction would meet certainly with some opposition in the United States, where our steel manufacturers have bent every effort to increasing the output, too often at the expense of quality and general reliability.

[illegible]

[illegible] to the Engineer.—The Assuan dam [illegible] works in Egypt have cost about [illegible], but the increase in the value of land in [illegible] and lower Egypt and the Fayum provinces has [illegible] from [illegible] to $2,440,000,000. The total [illegible] of this land has risen from $82,000,000 to $190,000,-[illegible]. This is what the engineer has done for Egypt in [illegible] one decade.

Large Austrian Floating Drydock.—The Austrian navy [illegible] built a floating dock for the use of its new dread-[illegible] battleships which can lift a vessel of 22,500 (long) tons. It consists of a pontoon body 541 feet in length and 17 feet high. At each side of the pontoon is a lateral [illegible] or wall 440 feet long, 11 feet wide and 63 feet high. The pontoon has 30 water compartments which the pumps can discharge in 4 hours. The dock carries a 150 horse-power compound engine and four 2.5-ton cranes.

One Thousand Feet Piers for New York.—The Board of Estimate of this city urges the immediate construction of eight new piers one thousand feet in length between Forty-second Street and Sixty-ninth Street, on the North River. It is proposed to keep within the present pier-head line, and obtain the necessary length by excavating back, inshore, to a distance approximately equal to the width of Twelfth Street. The waterfront in this district is at present given over to piers, the business of whose owners or lessees could be better accommodated at other points on the Manhattan shore line. The mayor of New York would go even further in providing for future development, by building the piers 1,200 feet in length.

Docks and Coaling Plants at Panama.—The plan of Col. Goethals for making Panama a point of supply of coal, oil, etc., for shipping is one of the best collateral features of the whole scheme. Several piers one thousand feet long will be built at Balboa on the Pacific side. Here also will be a drydock with a usable length of a thousand feet and depth of thirty-five feet, and a coaling plant storing and handling one hundred thousand tons of coal. Repair shops will be constructed which will handle large jobs of repair and refitting. At Cristobal on the Atlantic will be constructed several piers one thousand feet in length and a large coal storage plant, capable of handling and storing from 200,000 to 300,000 tons of coal.

The Caucasus Tunnel.—The administration of the Russian railways is seriously occupied with the project of a tunnel of gigantic proportions through the Caucasus Mountains. This tunnel, the largest in the world, would have a length of nearly 16½ miles, and it has been already the object of a conference between Russian and foreign engineers, who have found: 1. That the geological structure of the mountain does not present any great obstacles. 2. That during the borings of the galleries no such difficulties will be encountered as during the borings of the Simplon tunnel. 3. That the temperature can be maintained at about 77 deg. Fahr. 4. That the elevation of the tunnel being between 4,300 and 4,650 feet, there is no danger of encountering subterranean water courses. 5. The work will take about eight years. This great undertaking would insure a direct connection between Vladikavkas and Tiflis.

Naos Island Breakwater at Panama.—The piling for the great dike which is being built on the easterly side of the Panama entrance on the Pacific, extending from the main land for three and one third miles, is nearing completion, and before long all of the rockwork will have been filled in. There has been much settlement necessitating large additional dumping of rock. The total vertical settlement in one section during the period July 1st, 1911, to June 30th, 1912, aggregated 125 feet, and in some cases the movement of the mud has carried the trestle laterally as much as 300 feet, but the fill is now stable, and a carriage way will be built along its surface giving access to Naos Island. This dike prevents the carrying of sediment by the current which sets across the axis of the canal entrance from the east.

Rebuilding an Underground Canal.—About $2,000,000 is to be expended in rebuilding the underground section of the canal leading from the Marne to the Rhine. The Mauvages tunnel, as it is called, is 3 miles long; it was built about 60 years ago and carries the canal under elevated ground at this point. The old masonry lining proving insufficient, a new and heavier lining of beton is being put in throughout the whole length. Navigation may not be stopped and the work is carried out on the [illegible] system, which allows of working for short periods at a time. The process consists of dividing the tunnel into [illegible]-foot sections, each section being pumped dry in one hour's time to allow work to be carried on for one day, when the canal is again flooded to give passage to the boats. The pumping is done from two boat-like [illegible], one at each end of the section. The tunnel is [illegible] with a [illegible] beton lining, [illegible] of the section being about [illegible] feet.

Electricity

Electric Furnaces for Sheffield Steel Works.—A new steel works is being built by the Stobie Steel Company of Sheffield, England, in which only electrical steel melting furnaces will be installed. At first the installation will comprise a 15-ton, 3-phase furnace, a 5-ton, 2-phase furnace for special steel, and small melting furnace for alloys. This will be the first all-electric steel works in Great Britain.

Cost of Meals in an Electrical Restaurant.—An English electrical paper gives an interesting note of the prices charged in a popular London restaurant employing electric cooking devices. The prices are said to be far less than those encountered in the West End restaurants, while the cooking is beyond reproach. A simple lunch of soup, a chop with potato chips, mineral water and bread and concluding with a sweet and coffee, cost one shilling sixpence.

The Cable Not to be Supplanted by Wireless.—An announcement recently made by the directors of an ocean cable company once more emphasizes the fact that no detrimental effect whatever has been experienced by the rapid expansion of wireless telegraph communication. Just as in the familiar case of a new rapid transit system in a large city finding its own new business without taking from the traffic on existing means of transportation, so the cable companies are finding that there is ample room for both the old and the new systems in the increasing demand for transoceanic telegraphy.

Electric-light Carbons from Tar.—Carbons of high grade are now to be obtained from tar, according to a process invented by a Swedish firm. The powdered carbon will be pressed to form electric-light carbons or larger sizes for electro-chemical work. The method is based on the fact that finely-divided carbon makes up a large percentage of the composition of tar and is what gives the black color, this being due to the carbon particles suspended in an otherwise dense and transparent yellowish-brown liquid. A process is used for separating the carbon from the liquid, and it can then be molded into any desired shape.

Electric Instead of Compressed-air Cars.—Parisians will not regret the disappearance of the compressed-air tramway cars which have been running for so many years past, as these are now to be replaced by electric cars. The problem of surface traction in the city was a difficult one in the early days, owing to the fact that the trolley is practically prohibited within the city limits, and this led to the use of compressed-air cars of the double-deck type with trailers, upon quite a number of the principal lines. Now that the Thomson-Houston underground conduit has proved such a success, it is to be adopted extensively and the compressed-air cars are likely to disappear. The work of laying the conduits for the electric lines is now going on in many of the principal streets.

Blue Gelatin Copper.—Bancroft's method of ornamenting copper, nickel, brass or platinum is to make the metal the cathode in 325 cubic centimeters of a one per cent solution of copper acetate containing one gramme of gelatin and electrolysing for five minutes with a current density of nearly one half ampere to one hundred square centimeters of cathode surface. Immersion in a five per cent solution of copper acetate after electrolysis "develops" the deposit. If the plate is dipped in hydrazine hydrate before developing in the copper acetate the action is hastened. A variety of colors may be given the film, but peacock blue is the most beautiful. At temperatures above 50 deg. Cent. (122 deg. Fahr.) a red color appears and a short electrolysis between 55 deg. Cent. and 60 deg. Cent. with a lower amperage yields an iridescent gold film. The final touch is the application of a coat of lacquer.

Explosion Proof Motors.—The United States Bureau of Mines, following an investigation having for its purpose to ascertain the methods of lessening the risks attending the use of electricity in mining, refers to the term "explosion proof" as applied to an electric motor as defining a motor inclosed by a casing so constructed that an explosion of a mixture of air and mine gas (methane) within the casing will not ignite a mixture of the same gas surrounding the motor. It appears that there are two classes of motors so constructed; one a totally inclosed class built strong enough to withstand high internal pressures and another provided with relief openings or valves to relieve the pressure of an explosion within the motor casing and to cool any products of combustion discharged through the valves. A satisfactory motor of the first class is much more expensive to build than an equally safe motor of the other class, and attempts to make motors explosion proof have for such reason been confined chiefly to motors of the second class. The principle of the Davy safety lamp has been the basis of most of the protective devices, the application of the principle consisting in causing the discharged gases to pass over or through metallic plates or screens which by conduction remove the heat from the gases. In some types the cooling effect of expansion is also utilized.

Science

Dr. Carrel Sails for the Nobel Prize.—On the 26th of November Dr. Alexis Carrel sailed for Europe in order to receive the Nobel Prize.

A Memorial to W. T. Stead is to be provided by his countrymen, and a large and influential association has been formed in London to promote the enterprise. The memorial will probably take the form of hostels for women, in recognition of the fact that Stead was a knight-errant in the cause of womanhood. It is also proposed to erect a monument to the dead publicist on the Thames Embankment.

The New Deutsches Museum of Munich.—The Industrial Museum of Munich, which is one of the most important institutions of the kind in Germany, is taking measures to increase the efficiency of the establishment and especially to add to the industrial collections in the way of models or specimens. To this end it decided to send a commission to the United States in order to examine the industrial field and visit the museums. The collections are at present installed in temporary quarters, but a handsome building is in construction for the purpose and it will be inaugurated in 1915.

A Monument to Berthelot.—A monument is to be erected at Paris to the celebrated chemist Berthelot, recently deceased, and the statue is now being finished by the sculptor Saint-Marceaux. It will be erected close to the College de France which forms part of the University buildings, and not far from the laboratory where he formerly worked. The statue is an upright figure, and the base contains a series of appropriate bas reliefs, also a list of his discoveries and works, with the inscription, "Marcellin Berthelot, 1827–1907. Monument erected by international subscription."

Is Naphthalene a Good Insecticide?—The question as to whether naphthalene is to be recommended as an insecticide is discussed by the French scientists Lecaillon and Audige. This substance is commonly sold in the shape of small balls and is used in households, especially for preserving furs or various fabrics, but it appears that after being a favorite its use is falling off. They find that the toxic effect only takes place in a confined atmosphere and its action is slow. Furs or garments should be thus preserved in as tight receptacles as possible. It can also be used in horticulture in greenhouses for protecting against aphides and the like, but it appears to have no effect upon earthworms.

The Science of Detecting Crime.—M. Bertillon, the well-known chief of the Paris anthropometric service, is engaged in giving a course of technical and practical police instruction to the new criminal brigade composed of 200 picked men of the police force. The courses which have now been organized at headquarters are likely to be of value in training the men, and instruction is given in different branches by several specialists. The part which M. Bertillon has in charge includes conferences upon anthropometric service for identifying criminals, in which photographic views play an important part. Instruction courses of this kind also exist in other countries of Europe.

The Return of the Sea Serpent.—Capt. Ruser, who is now commander of the "Kaiserin Auguste Victoria" and has been designated to command the colossal "Imperator," is one of the best-known seamen on the Atlantic, and respectful attention will be accorded to the statement in his log of July 5th, 1912 (as quoted in *Annalen der Hydrographie*) that at 6:30 A. M. of that day he, as well as his first officer and an Elbe pilot who was on board, saw a sea serpent in the water close alongside the ship, then off Prawle Point. The creature was 20 feet long, and appeared to be engaged in combat with some other marine animal, as it was lashing the sea violently with its tail. Its color was grayish blue on the back and whitish under the belly. The body was between a foot and a foot and a half in diameter. Capt. Ruser says that the whole length of the animal was visible, and there could be no mistake about its reptilian form.

Volcanic Dust in the Atmosphere.—From many points in America and Europe come reports of an unusual turbidity of the atmosphere, which began early last summer and still continues. This is manifested in a marked diminution of the intensity of solar radiation, as measured with the pyrheliometer, abnormal displacement of the neutral points of atmospheric polarization, a hazy appearance of the sky, and the presence of Bishop's ring around the sun. From Dublin Sir John Moore wrote last August: "The sky is constantly covered with a thin film of uniform cloud in which no halos develop, and through which the sun, moon, and stars shine with a subdued, sickly brightness." Observers in Russia, Switzerland, Sweden and Germany, as well as America, report an unusual lack of blueness in the sky. There seems to be every reason to attribute these phenomena to the presence in the upper atmosphere of an immense pall of dust arising from the explosive eruption of Katmai volcano, in Alaska, last June. Similar effects were observed after the eruptions of Krakatoa and Mont Pelé, and in those cases lasted for some years.

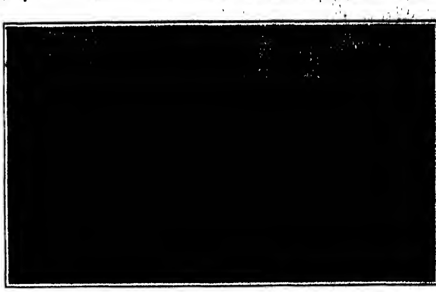
Street Paving With a Motor Truck

By Theodore M. R. von Kéler

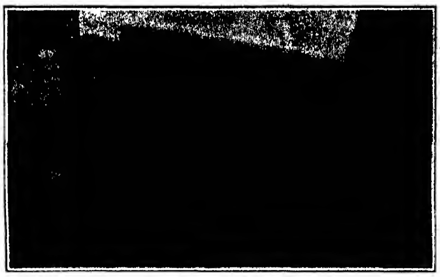
AN extraordinary vehicle recently appeared on the streets of Berlin, Germany. Resembling a railroad freight car, it rumbled along the pavements on wooden wheels with wide steel tires, and few of the passers-by could imagine for what purpose it was intended. It stopped at a corner where paving was being done, and there it resolved itself into a combination motor truck and pneumatic tamping machine, specially designed for street paving with Belgian blocks.

The motor is an 18 horse-power benzol motor, which drives the truck itself and also a compressed air apparatus for the use of the pneumatic tamping tools. Instead of lifting and dropping the heavy old mauls by hand at the rate of about fifteen a minute, the workmen place the pneumatic tampers on the stone and the motor "does the rest." It delivers 90 blows per minute under pressure of six atmospheres, and enables one man to tamp 130 square yards in a day of eight hours. By hand the same man could only accomplish about 30 square yards. The use of the motor-driven apparatus has also had an unexpected influence on the wages of the workmen. While formerly it was necessary to choose men of superior physique and great endurance and to pay them high wages, it is now possible to use any ordinarily-built man to handle the pneumatic machines. The work is comparatively easy, and naturally the wages paid are smaller, despite the fact that each accomplishes four times the amount of work that the more powerful man formerly could perform.

The entire truck is surrounded by a heavy wooden "box" which can be locked and left at the place of street repairs, without necessitating the employment of a watchman to keep guard over it. The compressor can supply air to three to eight men, while the truck pulls a trailer filled with stone blocks, sand and other materials needed in the work.



A battery of pneumatic tampers at work.



The power plant for the pneumatic tampers.

A Freak Racing Car

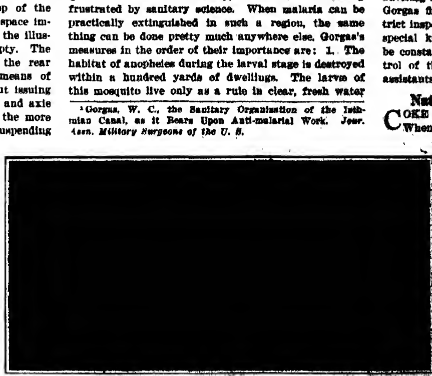
By G. M. Sommers

WHILE the "Bedelia" racing car, shown in the accompanying picture, did not win the famous annual Gaillon hill climb, in Northern France, it was easily the most talked-of machine seen in that event. With its extremely narrow, elongated shape it made an impression not easily forgotten.

The "Bedelia"—that is, the ordinary commercial "Bedelia"—is queer enough, but the racing variety is nothing more nor less than a freak. As will be seen from the photograph, it is propelled by a two-cylinder V-shaped motor, which is cooled by air without the assistance of a fan. Power from the motor is transmitted to the rear wheels by means of a leather V-belt, running along the left side of the car. The wheels are of the disk variety—that is to say, the wire wheels are protected by thin sheets of metal against injury, affording at the same time less resistance to the wind.

The huge gasoline tank is carried on top of the framework surrounding the motor, while the space immediately behind the power-plant, covered in the illustration by the numeral 75, is absolutely empty. The driver sits far back, almost directly over the rear wheels, and controls the front wheels by means of wire cables, carried within the long hood, but issuing just in front of the motor. The rear wheels and axle carry the body by means of leaf springs of the more conventional type, although the method of suspending the load is somewhat unusual. The front wheels are set on a tubular axle which supports the weight of the motor and gasoline tank on a spiral spring not unlike the so-called spring-frame arrangement of some motorcycles.

The ordinary "Bedelia," of which a good many are at present running on the streets of Paris, is a type of car which is absolutely unknown in this country. It is a tandem-seated contrivance, in which the passenger sits in front of the driver. As far as the system of motor propulsion is concerned, it is the same as in the racing car: a two-cylinder V-motor, acting on the rear wheels by means of a V-shaped leather belt. It is extremely light, so light, in fact, that two men can with ease lift the whole machine clear of the ground. It is fitted with Hutchinson non-skid tires and is manufactured by R. Bourbeau & H. Devaux, Paris. The ordinary "Bedelia" develops about 6 to 8 horse-power, and is capable of a speed of thirty miles an hour. The special racing model develops about 12 horse-power, and can attain a speed of a mile in a minute.



The "Bedelia," a freak racing car.

Anti-malarial Work

THOUGH there has been much anti-malarial prophylaxis in the United States since *Anopheles* has been demonstrated to be the carrier of the plasmodium, this disease is yet far from being eliminated, especially in the South. The facts fundamental to malaria extinction are well known; lack of success in any community must mean that the *modus operandi* has been inadequate and imperfect, the fault generally being that details have been neglected or ridiculed as too trivial for attention. A succinct statement of the procedures adopted against malaria in the Canal Zone by Colonel Gorgas and his staff should not therefore be amiss.[1] It is well known that conditions for anopheles breeding in the Panamanian Isthmus are ideal all the year round; nowhere else on the globe could this mosquito flourish so luxuriantly, were not its breeding frustrated by sanitary science. When malaria can be practically extinguished in such a region, the same thing can be done pretty much anywhere else. Gorgas's measures in the order of their importance are: 1. The habitat of anopheles during the larval stage is destroyed within a hundred yards of dwellings. The larvæ of this mosquito live only as a rule in clear, fresh water which is plentifully supplied with grass and algæ. Tile drains are the most effective and economical; once down they require no more attention; no water is exposed to the surface, there is no breeding place for mosquitoes; by means of a lawn mower or scythe the grass over the drain can be cut. Failing tiles, an open concreted ditch may be put down; but the first cost here is nearly as much as for tiling, and the concrete ditch must constantly be kept clear of obstructions, in which breeding pools may form. Open ditches are the least effective and most expensive. 2. All protection for the adult mosquito must be destroyed. The adult is weak on the wing, not generally flying far and needing plenty of grass and brush for protection against the wind. Brush and grass are therefore cleared for a hundred yards around dwellings; where the locality is to be occupied for a year or more, it is best graded and grassed, the latter kept well mowed. There is no objection to a little shrubbery or a few trees about a dwelling. 3. All habitations are screened, but effectively. Screens as ordinarily put up without expert supervision are of little use. Good wire should last three years; there is plenty of screening on the market that will not last six months. 4. When breeding places cannot be destroyed by draining, larvæ are destroyed by means of crude petroleum, Phinotas oil and sulphate of copper. The first of these is used in temporary pools, caused by bad construction, or at temporary camps where it would not be economical to drain, and wherever drainage is impracticable; the last two are used for killing the larvæ in the algæ and grass along the edge of a lake, a stream or a swamp.

For those interested in the health of industrial camps, Gorgas makes some exceedingly pregnant observations: In and about the Canal Zone fifty thousand laborers and their families are scattered over five hundred square miles, though they are principally collected in some forty camps and villages along the line of the canal; these five hundred square miles are divided into seventeen districts, all under a chief sanitary inspector, with the necessary clerical force and three assistants, of whom one is especially wise in mosquito lore, the second expert in ditching, draining, oiling, etc., the third a competent executive. Each one of the seventeen districts has its district inspector, who has from forty to fifty laborers to do the necessary draining, carpenters to keep the screens in repair, and one or two quinine dispensers, who go about urging though not compelling employees to take three-grain pills as prophylactic doses. The district inspector reports daily to the central office the number of malaria cases and the number of employees among whom the patients live. Each inspector is held responsible for any excess of malaria in his district. If the admission rate for malaria during the week rises above one and one half per cent something is considered wrong, and the assistants to the chief sanitary inspector are sent to discover the cause. These assistants are moreover kept constantly busy over the work, advising and instructing the district inspectors. Herein Gorgas finds the gist of the whole situation: the district inspector and the working force having usually no special knowledge of mosquito life and habits, must be constantly under the surveillance and supreme control of the sanitary officer and his trained scientific assistants, who should then be held responsible.

[1] Gorgas, W. C., the Sanitary Organization of the Isthmian Canal, as it Bears Upon Anti-malarial Work. *Jour. Assn. Military Surgeons of the U. S.*

Natural Coke and Volcanic Graphite

COKE is made in nature as well as in brick ovens. When hot volcanic material comes into contact with a coal bed, under the proper conditions, it makes very good coke indeed, although not in sufficiently large deposits to be commercially valuable. Such natural coke is often found by the geologist or the prospector.

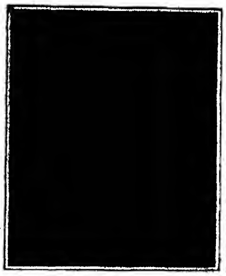
Graphite is also manufactured out of coal by volcanic heating, and in this case the product is commercially important. Graphite is nearly pure carbon. In geologic examinations of the deposits of the Raton coal fields in New Mexico, Geologist Lee found some excellent examples where coal had been metamorphosed into graphite by comparatively recent intrusions of hot volcanic rock, the combustion of the coal being prevented by the absence of air. Man is now manufacturing graphite as well as coke out of coal.

A New Gun for Throwing Bombs and Life Lines

By Jacques Boyer

THE portable cannon recently invented by M. Mathiot is capable of throwing objects of considerable size and small density to a moderate distance, but without great precision, which can be obtained only with a rifled gun and small, heavy projectiles. The Mathiot gun, however, was designed for uses in which great accuracy of fire is not required. Chief among these uses is the throwing of bombs which emit suffocating gases into the haunts of dangerous criminals, in order to capture the malefactors without risking the lives of policemen. It may also be employed in war for throwing light bombs, in shipwreck for throwing life lines, and in conflagrations for scattering fire-extinguishing powders and cutting off the advance of the flames.

Fighting fire with the Mathiot gun.



Throwing a lifeline with the new Mathiot Gun.

The gun in action behind a specially designed shield.

The accompanying drawing shows the gun in section and in outline, and also an enlarged section of the breech. The barrel *a*, of large bore and varying in length from 28 to 45 inches, in different models, is securely attached to the breech block *c* by means of the groove *d*. The breech block contains a hemispherical cavity, with a cylindrical extension into which can be inserted the tube *e*, containing a central-fire blank cartridge *f*, of the usual type. The cartridge is exploded by striking with the hand the flat round head *h* of the hammer *g*, and thus driving the point of the hammer against the fulminating cap. The shaft of the hammer is a square rod which moves with slight friction through the breech stopper *i*. The outer end of this stopper carries a screw thread fitting a corresponding thread in the end of the breech. The stopper is screwed into the breech until the rim of the hollow inner end of the stopper presses firmly upon the cartridge. This operation is effected by timing the head *h*; as the stopper necessarily rotates with the square rod *g* after firing, the stopper is unscrewed and the gun is inclined until the tube *e* slides out. The spent cartridge in the tube is then replaced by a fresh one, and the tube and stopper are again inserted in the breech. The hemispherical cavity in the breech block allows the gases of combustion to expand before they act on the wad *k*, which is interposed between the cartridge and the bomb or other projectile.

The gun is suspended from the body of the gunner by a novel and ingenious harness, designed to minimize and distribute the shock of the recoil. The breech of the gun is attached by the spring *u* to the girdle *s* (see drawing) and additional support is given by straps passing over the shoulders and descending to the ground, where they terminate in loops in which the feet are inserted.

In the first model adopted by the inventor the range was found by making trial shots with an attached spring gun *l* and noting the position which the air

(Concluded on page 497.)

Liquefying and Bottling Illuminating Gas

By Frank P. Peterson

GASES are the most fascinating of materials with which we have to deal. They represent matter in its final form, its permanent form, if it have such, and permanency approaches nearest to perfection of matter. In our past dealings with matter we have locked upon gases as the evidence of dissolution, decay, disruption, and it is only recently that we turn our minds to the restoration or reconstructive uses to which we may apply our knowledge of gases and their physical adaptations.

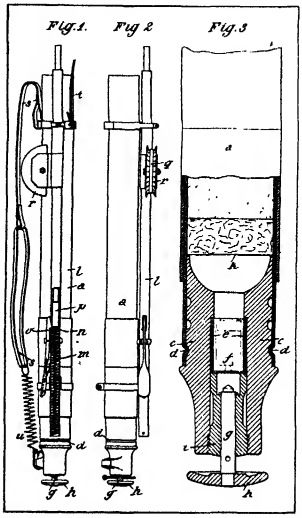


Fig. 1.—Section of the gun. Fig. 2.—Front view. Fig. 3.—Section of breech.

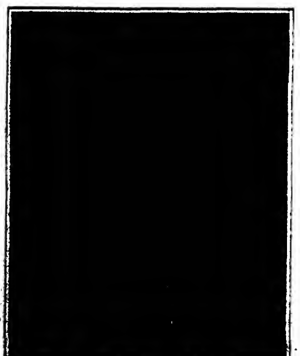
Since the adaptation of gas to the supreme comfort of light and heat, until recently, we were willing to let it go at that. If we needed gas at any place, we compounded it, like nitro-glycerine, and used it, where required, because of its difficulty of transportation. And because of the similitude some people are likely to confound also the dangerous qualities of gas with those of the deadly explosive. Such is far from a true conception, however, and the deterring influence has been cost, and not danger, of transportation.

Every material thing has, or is capable of having, three physical forms, the solid, the liquid, the gaseous.

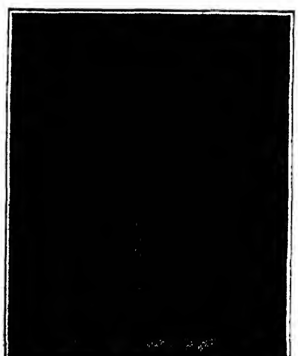
Transportation, as a simplified problem, deals with them in the inverse order as named, and it is not uninteresting to note that we transport the first two through the dynamic forces exerted by the third, and we measure now by months the young art of adapting the gaseous form to such decreased bulk as permits us to handle, transport and deliver it as we do its component solid or liquid equivalent.

The coming of railway carriages of house proportions probably created the first extensive real need of

Bottles filled with liquefied gas and ready for transportation to the consumer, to any distance and by any means, with greater safety than ordinary gasoline or kerosene in cans, or acetylene or carbide.



Dr. Walter O. Snelling, inventor of a new compressed gas retained in liquid form in strong steel bottles. It revaporizes perfectly, even at a temperature of 40 degrees below zero.



Service cabinet containing enough gas to last a small family two months. An empty bottle is replaced by a full one by loosening the nut indicated by the arrow at the left.

a transportable gas. The liability to wreckage and the spreading disaster of lamp oil on fire made evident the direct necessity for departure from lamp oil. Then came Pintsch with compressed gas. And thereby was demonstrated, first, the safety and, second, the possible economy of transporting gas. The greatest credit which is due to Pintsch is that he dismissed from the minds of the public the hobgoblin of fear of a compressed gas. After that came the transportation of vast volumes of natural gas compressed into such small bulk that it can find its way through long reaches of pipe and expand to its normal bulk, when finally released and consumed. Pintsch could crowd somewhere in the neighborhood of 250 cubic feet of his gas into a tank having a volume capacity of around 13 cubic feet. If the big gas main leading out of Hastings, W. Va., can comfortably deliver 2,400 feet of gas a minute at such pressures as are required at the burners, it can just as readily pass 57,000 cubic feet per minute along at the pressure it sustains of 350 pounds per square inch.

The volume of a gas, the temperature being always the same, is in inverse ratio to the pressure applied to compress it, the unit of pressure being 14.7 pounds per square inch, or one atmosphere, and this rule holds good just so long as the gas retains its gaseous character. Had Pintsch gone on in the application of greater pressure to his gas he would presently have secured it, or a goodly portion of it, in a liquid form. There would have been some waste, however, in a portion which would not liquefy and also in a portion which would not regasify. So Pintsch, studying economy, stopped where he thought the best results were obtained. Blau and Linus Wolfe came later. Going at the work on a much larger scale than Pintsch's early developments permitted, and with Pintsch's experience and accomplishments on record before them, these men were able to adapt the wastes to the form of useful energy to carry on the process, thereby forming a closed circuit in the operation and claiming much greater economy. It is a pity that Pintsch stopped where he did, for the claims of Blau and Wolfe to greater economy are justified only in the lesser cost of transportation of a liquid as against a gaseous form of fuel. Even this claim is open to grave question, notwithstanding it is accepted by some of the foremost economists, if the great captains of industry may be so classed.

At any rate, Blau and Wolfe reached the goal of transforming gas fuel to liquid form. They were compelled to use much greater pressures than Pintsch. Their efforts are rewarded with world-wide appreciation and approval. These pioneers made their gas from oil. They recognized only the safe source of large supply that oil seemed to insure.

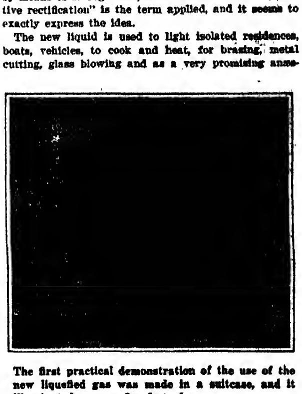
Why, we may ask, do not the transporting companies that handle natural gas resort to the means of Blau and Wolfe in the handling of their gas? The answer is twofold. It is, first, impracticable, because of the enormous pressure involved and the weight and strength of pipe thereby required, and finally impossible because of the abnormally low temperature demanded by natural gas to maintain it in the liquid form. They follow, therefore, consistently, Pintsch's compromise and compress the gas only to the reasonable and safe limits of strength of comparatively cheap, thin walled steel tubing.

Not until the compressing of natural gases from oil wells for gasoline justified a most extensive study of their composition, was the most recent phase of gas and adaptation to liquid form suggested. This extensive investigation was mentioned in a former article describing that interesting modern petroleum development. It set forth the following facts: Petroleum gases are of widely varying general composition. They may be, and now are, classified in two great groups, dry gas and wet gas. The latter term is misleading when understood to have reference to water, though some gases do carry suspended small percentages of water moisture. The wet gases may be separated into different compounds, both liquid and gaseous. The dry gases cannot be liquefied readily, and must, under all commercial conditions, retain their gaseous nature. No sooner is the fact recognized that these gases exist in sufficient quantity to justify their salvage and distribution to human comfort than we find the genius and the man of science ready to devote his time to it. Walter O. Snelling, doctor of physics, of science and of chemistry, cast aside the obstacles and they fell, in the final perfection of the system of treatment to produce the new liquid gas, and he applied one of the most beautiful theories imaginable.

Now every gas possesses a peculiar trait called its critical temperature, and it also has a corresponding critical pressure. This pressure matter is immaterial in some sense because we can usually acquire it without great effort. Beginning with the most prevalent of the components of complex natural gases, such as here considered, we take up methane. To liquefy it, no matter what the pressure, we must reduce its temperature to about 115 degrees below zero Fahr. Eight hundred and twenty-five pounds per square inch will serve when we have reached this frosty state to reduce methane to liquid. After we have accomplished the result, and as soon as the temperature starts back to normal, the pressure begins to jump up the scale. It appears then, that we will not attempt to liquefy this product on a commercial scale at least. Next let us examine ethane, the second in the compound. If we use a temperature of 95 degrees above Fahr., we may liquefy it at 678 pounds pressure per square inch. Then let us take the third, propane, in the compound. Two hundred and seventy degrees Fahr. and 660 pounds will do for its liquefaction, or any combination of lower temperature and corresponding pressure may be used. Butane (and all the above named compounds may be found in the complex gases) will yield to maximums of about 300 deg. Fahr. and 550 pounds, or correspondingly more reasonable figures.

We find Dr. Snelling's ingenious mind evolving such a chamber as will withstand any one of the above named pressures. Condensing coils, regulated in temperature to accommodate each of the compounds as are wanted in the new liquid, if need be, are set within the chamber. Now, it will be seen that, if a coil maintain a temperature in excess of that which is critical for any one of the fractions above mentioned, that fraction cannot condense upon that particular coil, but must pass on to the next which affords the requisite physical condition. Each coil is provided with its own receiver arranged to separate the liquid condensing against it and to convey it outside of the main chamber, where, by means of strong cocks, it can be drawn off. "Selective rectification" is the term applied, and it seems to exactly express the idea.

The new liquid is used to light isolated residences, boats, vehicles, to cook and heat, for brazing, metal cutting, glass blowing and as a very promising anaesthetic. It is retained in the liquid form in strong steel bottles. For absolute safety it is placed in a cabinet, outside of a housing of any kind, on the top or outside of a boat or railway car. The butane, above mentioned, will readily liquefy, if the temperature goes much below zero Fahr., and some pentane, if we do not "rectify" it out, can be liquid at 99 deg. Fahr. Now, supposing these fractions are allowed to remain in the liquid gaseous compound, they tend to go over through the piping system in their liquid form, and, upon reaching the warm temperature of the interior of a living-room, the result is irregular expansion to gaseous form, fluctuation of pressure and general defeat of the perfect results sought. That all this has been carefully anticipated is evidenced by the fact that perfect revaporization of this gas takes place at 40 degrees below zero Fahr., and the steadiness and even qualities of the lights are remarkable under every kind of condition.



The first practical demonstration of the use of the new liquefied gas was made in a suitcase, and it illuminated a room for forty hours.

No pure gas has been found which will exist in the gaseous state through the range of pressure and temperature of the new gas and give its equal in heating value.

From 2,200 to 2,400 British thermal units per cubic foot are registered for it, as against 1,800 to 1,900 for the best artificial products in liquefied form, 1,575 for acetylene gas, 1,060 for good natural gas, 650 for high-class Lowe process carburetted water gas, 550 for average coal retort gas, etc.

The pressure at which it is retained in the steel containers do not exceed 750 pounds under extreme conditions, such as exposure to hot sunshine. It is absolutely non-poisonous in the sense of blood depletion, and when diluted with any considerable amount of air is neither dangerous nor offensive to smell. Its range of explosible admixture with air is less than that for any other gas. It is put into convenient size packages and can be transported to any distance and by any [illegible] or [illegible], and [illegible] acetylene or carbide, or [illegible] no effect upon it.

And, finally, it is the cheapest [illegible] form of gaseous fuel, being about [illegible] manufactured illuminating gas of the [illegible] $1.25 per 1,000 cubic feet.

A Curious Gift to the City of Evansville

ON October 29th, 2161, the city of Evansville, Indiana, will be richer by [illegible]—that is, if the provisions of a deed of gift of Adolph Meiser of Evansville are strictly carried out. Mr. Meiser deposited with the City National Bank of Evansville the sum of one thousand dollars to be held by the bank, its successors and assigns under the following conditions: Interest upon the sum deposited is to be credited and added to the principal at the rate of 4 per cent per annum every six months for the period of 250 years, during the whole of which period the interest shall be compounded. At the expiration of the period of 250 years, the sum will amount to [illegible]. This is then to be paid over to the city of Evansville as a gift from Adolph Meiser. In commenting upon the gift, the *Evansville Journal News* writes as follows:

"What will the Evansville of that time be? How large? How wealthy? Will wealth be the same inspiration for service that it is among Americans to-day?

"History has shown that many things may happen in 250 years. History has also shown that few things may happen in that length of time. There are cities on the eastern coast in this country that have been established for that length of time and have undergone comparatively few changes, apart from natural growth and a shaping of their destinies according to development of political forces. In the old countries are many cities in whose histories 250 years is like only one chapter in a book, for they have existed for a thousand years or more, and many historic cities of antiquity are surviving to-day with modern atmosphere. Centuries are in their cases as the years of a man's life.

"So, while on the score of past historical comparison we should say comparatively little may happen to change the organic character of a city's existence in even so long a time as 250 years, these comparisons are not furnishing us an accurate idea to what we may expect in the future.

"It remains an open question, just what the Evansville of 2162 will be—a question for which there are as many solutions as individuals. But, at that, it is very interesting to think about."

Results of the Gordon Bennett Balloon Race

THE official result of the international balloon race for the Gordon Bennett Trophy, which started at Stuttgart on October 27th, was announced on November 23d. The balloons were placed as follows:

"Picardi," France, first, 2,191 kilometers (1,361 miles 5½ furlongs).

"Ile de France," France, second, 2,001 kilometers (1,243 miles 5 furlongs).

"Uncle Sam," United States, distance unrecorded.

"Frankfurt," Austria, 1,769 kilometers (1,100 miles).

"Zurich," Switzerland, 1,523 kilometers (946 miles 4 furlongs).

"Reichsflugverein," Germany, 1,385 kilometers (860 miles 6 furlongs).

"Minckelers," Belgium, 1,291 kilometers (802 miles 3 furlongs).

"Honeymoon," England, 1,253 kilometers (778 miles 6 furlongs).

The other balloons covered less than 745 miles each while the "Million Population," America, made only 646 kilometers (401¼ miles).

The protest of John Watts of St. Louis, against the ruling out of the race of the "Duesseldorf II," was rejected by the judges committee.

Coppered Brass Decoration

A DESIGN, outlined in copper on a brass plate or brass on a copper plate is very attractive. This can be obtained by covering the brass sheet with solid chloride of iron and heating a few minutes. Zinc, as is well known, displaces iron from its salts, itself passing into solution. Since brass is an alloy of copper and zinc, the treatment removes the zinc from the surface layer. Of course iron is deposited, but when the plate is washed it all comes off, leaving a copper surface.

Now melt a thin layer of paraffin over the plate and trace the outline desired in the paraffin, scratching down to the metal. Pour dilute nitric acid over the plate, and in a minute wash off and melt the paraffin. It will be found that the acid attacked the metal only where the paraffin had been scratched away. The thin copper surface layer has been eaten, exposing the brass beneath, and the design appears in brass against a copper ground.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Short Crossover Controversy

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the crossover argument in the November [illegible] issue of the SCIENTIFIC AMERICAN: I am a practical [illegible] railroad operating department official, and naturally my sympathies are with the railroad [illegible], but your argument on the crossover makes Mr. McHenry of the New York, New Haven & Hartford Railroad look like the proverbial thirty cents. Your logic and [illegible] show a full comprehension of the practical difficulties of railroading, show an accuracy of conception and a [illegible] beyond question; to this you have added a [illegible] spirit, and your motive for the benefit of the traveling public is certainly an exalted one. Compared with this, Mr. McHenry's argument is wanting in courtesy and wanting in accuracy. With a slow order of 15 miles per hour, Mr. McHenry must know that very few trains in every-day operation slow down to such a speed. The Pennsylvania's slow order of 35 miles per hour for crossovers is practically speaking a privilege to make 50 or 60 miles, and the traveling public, as I myself have experienced, ride at this speed on crossovers so many times that Mr. McHenry's arguments seem pitiful. As to an automatic train-stopping device, in connection with which Mr. McHenry seems to be wofully ignorant; this is not a complicated device, does not require any great ingenuity; there are many of them in the Patent Office; many of them are on the market, and any good mechanic could make one; yet it seems Mr. McHenry thinks the same preposterous. It is the arbitrary, irritable, unreasonable, illogical, and personally critical opinions promulgated by railroad officials that are causing much of the railroad legislation of to-day. The principle is clear. When vice-presidents give out unreasonable excuses for passenger train wrecks and show wanton indifference to the general subject matter, safe railroading, the natural course of events is for the law-making bodies to take action, and it is both logical and reasonable as well as proper that they should.

Your argument on the short crossover is not only proper and accurate, but in view of your position and the second accident of this kind, there is no argument for a short crossover that appeals to a man of reasonable intelligence, of any reasonable practical experience.

Council Bluffs, Iowa. W. K. McConnel.

The Solar Engine in Egypt

To the Editor of the SCIENTIFIC AMERICAN:

On my return from Egypt, I have been shown two letters from your valuable paper, the SCIENTIFIC AMERICAN, one dated October 25th and the other October 31st.

We constructed a fine sun-power plant in Egypt of 100 horse-power, and it started up excellently and gave even better results than we expected, but we had not calculated on the intensity of the sunlight in Egypt, and the zinc boilers, which stood very well in America, were unable to hold out. The temperatures obtained came near the melting point of zinc, and the zinc softened and hung down like a dish rag. We were therefore compelled to put in new boilers, which are now being constructed in England. These boilers will be of one eighth inch thick steel, and every joint welded with oxy-acetylene. We feel sure these boilers will stand the temperatures. More water space has also been given, and more steam space.

We expect to start up again about the end of March, and will then be very glad to give you full information and photographs.

The pump we had in place could handle 6,500 gallons per minute. We found the engine could do much more than run the pump, and therefore had arranged already to increase the capacity of the pump to 12,000 gallons per minute, but before we could get this done, our boilers showed signs of failure.

You can see from the above that the general proposition of sun power is an assured success. The inventor of a new fuel which burns out his boilers, should rather be happy about the matter than otherwise, as he evidently obtained better results than he expected. Of course, the delay is extremely disappointing, as the entire country is interested, and we had hoped to give a fine public exhibition about the middle of October.

Tacony, Pa. Frank Shuman.

Control of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN:

I am delighted to note that you are giving space in your correspondence columns to the discussion of the problem of the Mississippi. This subject, like that of the Panama canal, is admirably adapted to the national[illegible] of American [illegible], a result much to be desired in a country of such varying elements of population and interests as our own.

I agree heartily with Mr. Yourtee that "any work in this direction . . . should be preceded by intelligent understanding of the situation," but as heartily disagree with him in thinking that "a choice must be made between some system of diversion o· higher levees."

We must go at this job as at any other we wish to have properly done, namely, by beginning at the bottom. But the bottom of a river system is at its top. That is where it starts, and that is where it can most readily be controlled. We learn from our geographies that certain characteristics and facts pertain to all of that large class of rivers of which the Mississippi is one, namely, that these rivers have their rise in hilly or mountainous regions; that they flow toward the ocean on beds which become more and more nearly level as their mouths are approached; that moving water carries sediment and in proportion to the rate of its motion so long as it can find the sediment to carry; that as the river reaches its lower and more nearly level portions it drops more and more of its sediment; that this causes the raising of its bed and the building of banks slightly higher than the surrounding country; that with the constant raising of the banks and the bed there inevitably comes a time when the banks are broken through and the river finds a new course to the ocean; that the deposition of sediment causes the stream to become very tortuous, thus decreasing its motion and causing it to deposit a larger and larger percentage of its sediment in its middle or sub-middle sections; and that as this process continues, the danger of sudden floods causing a break in the stream's banks becomes greater and the ensuing calamity more disastrous.

Now it follows from these observations that any plan of either building higher levees or providing additional outlets is but temporizing with the problem. The higher levees must soon become, as they are to-day, a positive danger; and the additional outlet only doubles the time which may elapse before the one true plan *must* be adopted.

That plan, if my reason serves me correctly, is the construction of reservoirs in the upper courses and tributaries, in the case of the Mississippi the numerous tributaries of the Missouri in particular. The advantages of this plan are various.

From a national viewpoint it has the advantage of serving more than one section of the country. The reservoirs would be a great blessing to that section of the country in which they would be located, helping to increase the scant humidity of the atmosphere, relieving the monotony of the landscape, and furnishing means of irrigation, ice making, fish culture, various sports, and last and probably least in real value, some water power. But they would just as surely benefit the region of the lower Mississippi by reducing the danger of floods and at the same time increasing the dependability of the river as a means of navigation. For the clarifying or partial clarifying of the waters of the lower Mississippi by means of these reservoirs would have the effect of making the river pick up instead of depositing sediment, which would have the further effect of causing the river to deepen its channel and straighten its course (like the lake-fed St. Lawrence) thus increasing its rate of flow and still further increasing the desired results. And the most comfortable part of the change thus wrought would be the knowledge that the benefits thus derived would be self-perpetuating instead of being mere postponements of an ever-increasing danger. Thus we have the advantage of urging the expenditure of the nation's money for a more truly national benefit than the mere relief of the lower Mississippi by an additional outlet could possibly afford.

Likewise, from an economic viewpoint the advantages would be marked. The first reservoir constructed would immediately take off the keen edge of the danger of a break in the present levees, a relief that might mean everything to thousands at the critical moment. There would be no waiting for the completion of a great undertaking of great expense and somewhat doubtful utility before any advantage could be realized.

And last but by no means least, from an engineering viewpoint, this plan offers the tremendous advantage of making its first work a perfect foundation for any further improvement of the Fathers of Waters which future generations, more opulent than ourselves, might wish to undertake. Thus with the Northwest well supplied with these reservoirs, one does not have to stretch his imagination greatly to see the time when the entire courses of the Mississippi and Missouri rivers will be supplied with dams and locks and made into channels of commerce far more pretentious than that now asked for in the feeble cry of "fourteen feet through the valley."

Noble, Alta, Canada. N. J. Noble.

An Aviator on Gyroscopic Force

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in the statement of R. S. Moore in your October 19th issue regarding the death of Paul Peck, the aviator.

Referring to Mr. Thomas Preston Brooke's argument in the SCIENTIFIC AMERICAN of September 28th, *in which he attempted to prove that Peck's death was due to the gyroscopic action of the rotary motor in his aeroplane, I would say that Mr. Brooke has repeatedly claimed that various aviators have met their deaths from this terrible (?) force.*

Did anyone hear of an aviator who has really had experience with a rotary motor complain about the gyroscopic action? Mr. Brooke acknowledges that Paul Peck never had any trouble with gyroscopic force, and yet as soon as Peck is dead and is not here to defend himself, he blames his death upon this gyroscopic effect. If it was so dangerous and if it killed Mr. Peck, why didn't he at least know of its existence before his death? I have seen Paul Peck do some pretty fancy flying, and the fact that he never was aware of any gyroscopic action leads one to think that it was not very pronounced.

There is no arguing the fact that there is a gyroscopic effect when a rotary motor is used, but I claim, as a practical aviator, that this fuss about gyroscopic action is all nonsense, and *it is absolutely negligible in practice.* As I have flown more miles in a monoplane, using a rotary motor, during the 1911 season, than any other American aviator, or I might go further and say than any other aviator in America, I am speaking from experience. Neither have I an "ax to grind," as I am not in any way connected commercially with the development of the aeroplane.

There are enough impediments in the path of the development of the heavier-than-air flying machine without putting a lot of imaginary obstacles in its way, and I claim that this gyroscopic bugaboo falls under this head.

Newton Highlands, Mass. Earle L. Ovington.

Wanted: A Small Gasoline Plow

To the Editor of the SCIENTIFIC AMERICAN:

Under the foregoing heading Mr. E. M. Blacksher makes some remarks which I undertake to answer from the standpoint of the owner and operator of a gasoline plowing outfit.

Mr. Blacksher's observations are not new. Gasoline plows can be purchased in the American market at the present time. There are no mechanical difficulties in the way of manufacturing a successful machine. Only the question of economy is involved.

The farmer who is most likely to create a demand for the type of gasoline tractor referred to by Mr. Blacksher carries on diversified farming. He raises hay, corn, feed, and stock. He must have a number of horses to do tasks that cannot be performed with a tractor with any degree of success. He raises his own feed, and there is no reason why he should not raise his own horses. If he does, he is not likely to take a very lively interest in machinery.

In figuring the cost of plowing or hauling with machinery, at least four items must be considered.

First of all is the interest on the first cost of the power plant. Second, is the cost of fuel, lubricants, etc. Third, comes the cost of labor. And fourth, some allowance must be made for depreciation.

The first item must be relatively large for a small outfit, because for various reasons it is not possible to build a small tractor as cheaply per horse-power as a large one. The second item is also in favor of the larger tractor. On the third item there can be no argument, because one man can operate a large tractor quite as easily as a small one. A good man can drive a 60 horse-power tractor pulling eight plows and plowing twenty acres per day. It will take one man to operate a 15 horse-power tractor pulling two plows and to cover five acres per day. It takes just as much mechanical ability to operate the small tractor as the large one. The last item is much the same as the third. Two engines of equal material and workmanship will make the same number of revolutions and cover the same number of miles before they are worn out, everything else being equal. The small tractor has to travel four times as many miles to plow the same number of acres as the large tractor. Therefore it will wear out four times as fast as the big one on the same acreage.

This comparison does not hold with horses, which is to the advantage of the small farmer. The real demand is not for a small tractor, but for a better large tractor. The demand for large tractors is real and urgent; the demand for small tractors not nearly so important. What is wanted is an engine that will operate successfully on the cheaper oils. This must be a Diesel or some modification of the Diesel engine. It must be better balanced than our present engines. The frame should be substantial, and hot-riveting should be used wherever possible. The gearing should be of the best steel, cut and machined and inclosed so as to run in oil. This would prevent rapid wear, because dirt could gain no access. It would also prevent expensive delays and breakdowns.

An engine such as I have in mind would find a ready sale among men of mechanical ability, men who would do the plowing and all the heavy work for small farmers more cheaply than the same work could possibly be done by a small machine.

Judith Gap, Mont. Ingolf Birkeland.

How Electricity Makes the Dairy Cleaner

Watertight Electric Light Fixtures Permit of Thorough Daily Washing

By Putnam A. Bates, E.E.

Fig. 1.—A row of electric lights on each side of the stable back of the cows and a few lights on the ceiling over the center aisle give sufficient illumination.

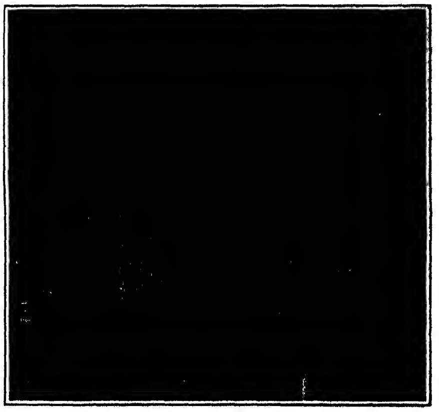


Fig. 2.—In this picture is shown a bottling room at a "certified" milk farm in Morristown, N. J. The hose is used twice daily to wash down the entire interior. In fact, all buildings at this farm undergo the same treatment.

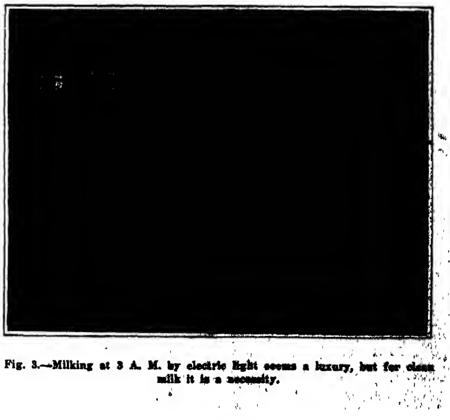


Fig. 3.—Milking at 3 A. M. by electric light seems a luxury, but for clean milk it is a necessity.

EVERYONE knows that the secret of success in dairy farming is cleanliness.

Where there are two commercial dairies in a community, the one giving the more attention to sanitation will naturally stand the higher in popular opinion, and this is true irrespective of other commercial conditions. But how may cleanliness be assured? Good light and plenty of good clean water are the requisites, of course. The question then becomes: How may these be obtained most conveniently?

Dairy farms are all improving very rapidly, and it is an interesting fact, not generally known, that 50 per cent of the large milk producing farms of this country to-day use electricity at least for lighting purposes, and in a considerable number of such instances the current is also used for pumping and other power purposes.

While the advantages of electricity lie not in cleanliness alone, undoubtedly where dairies are so equipped, this factor proves the greatest benefit.

The writer's purpose is to describe the conditions at two of the leading dairies of New Jersey. The larger one comprises a farm of twelve hundred acres, at Plainsboro, N. J., 70 per cent of which is under cultivation. From 3,500 to 4,000 quarts of milk is the daily output of this dairy, and the milk finds a ready market at a good price. The milk is clean and the conditions under which it has been produced and shipped are such that no change can take place in its content until the bottles are opened by the consumer.

The engine room at this dairy is equipped with a 25 kilowatt electric generator directly connected to a simple reciprocating steam engine. From this unit emanates much of the life and activity of the entire establishment. It is, perhaps, unjust to say that this is the most important feature of the dairy, because there are a great many departments in such an enterprise, each having successfully to carry its burden. But it may be said, without prejudice, that as the current is used for lighting or power in each and every important building on the farm, should the electric service which this little set provides, for any reason fail, the loss would immediately affect the operation of all the other departments on the farm.

This is an evidence of the position which electricity holds in one of the largest and best equipped commercial dairies in America.

In the accompanying illustrations we show two interior views from a well-known dairy which supplies milk to several of our eastern cities and suburban communities. These are representative of its class, and, therefore, will serve for elucidation.

Fig. 2 shows the bottling room in the other dairy, Morristown, N. J. This is a "certified" milk dairy, and one of the requirements under which the product is produced is that the interior of all the milk buildings shall be washed down twice daily. In this room a watertight electric light fixture is in the ceiling, directly over the bottling machine. No other means of permanent lighting could be used in such a place and permit of this rigorous cleansing. Portable oil lanterns are not clean, therefore they are quite unsuitable for milkers to have to depend upon, in a sanitary dairy.

One dairy, the cow stables of which are shown in Figs. 1 and 3, has made its growth on the basis of cleanliness. Each building, while simple in construction, has embodied in its design every idea that will make for better sanitation.

In the upbuilding of this institution one of the first equipments adopted was an electric generating plant, used at first for lighting the residence and office build-

(Concluded on page [illegible].)

[illegible] Novelties in Glider Construction

By Noel J. [illegible]

GLIDERS have become so common nowadays that the general form and dimensions required for sustentation are well known; in fact, almost every amateur of any ambition has made or is making one of the standard biplane pattern, with slight variations in regard to the position and operation of the rudders, curvature of the wing surfaces, and manner of control. After he has experimented for a short time with his machine the amateur will usually discover that his means of alighting is dangerous, that the arc described by the horizontal rudder is of insufficient amplitude for maintaining stability, and that altogether the machine is too unwieldy, and so bulky that it requires more space for storage than he has at his disposal.

Having had some experience with machines of this description, and having met all the difficulties enumerated, I will attempt to give some idea of the manner in which I overcame them, so that prospective builders will profit by my experience. The machine which I chose to build is the one described in SCIENTIFIC AMERICAN SUPPLEMENT No. 1582, with the slight difference that four feet was added to the span of the wings. I soon found that the rudder was open to the triple objection that it was clumsy to operate, did not have enough working space and was so low that on landing it was very liable to be seriously damaged. Accordingly the form of the support was changed to that shown in Fig. 1, which, of course, increased the angle through which the rudder might move and elevated it to such an extent that there was no more danger of injury. The control system and seating arrangements which were employed are illustrated in Fig. 2. The seat is of canvas securely sewed and so made that it may be slid back and forth readily on the supporting members to suit the operator. The control consists of two parts, movable, as indicated by the arrows, that which moves the vertical rudder sliding laterally over the bar which controls the horizontal rudder. The latter moves up and down and is guided upon two of the struts. Both members of the control are provided with wire hooks which pass entirely through the wooden bar and receive the loops in the picture-frame wire which is used for working the rudders. It may be observed that the hands need never be removed from this type of control for working either of the rudders, and that it is much lighter, more positive, and has a greater range than has a lever. The rudder wires pass over light brass pulleys which may be purchased at any hardware store. A plan view of the rudder arrangements is shown in Fig. 3, while a lateral view is shown in Fig. 1. These are self explanatory.

Skids may be made so light and are so serviceable, that it is a wonder that they are not used more frequently. An idea of their construction may be gained from Fig. 1. They should be braced to the machine laterally by means of piano wire. In landing they should be allowed to support the weight of the machine only, the operator taking care of his own weight by himself.

Using the construction which I have endeavored to describe, it will be found very easy to make the machine demountable. The front and rear rudder supports and the skids may be removed and placed between or above the planes, and the whole will be found to occupy about one fourth of the floor space required previously. To make this possible all control wires should be provided with loops which may be slipped over hooks when the machine is being prepared for an experiment. In my opinion the removable frame should always be securely lashed to the plane members with leather belt-lacing in preference to being bolted, as bolts are not only heavy, but are very liable to weaken the frame if much skill is not used in attaching them.

The experimenter must change the dimensions to suit his own type of machine; those given are intended merely as suggestions. I might say that for the glider referred to in SCIENTIFIC AMERICAN SUPPLEMENT No. 1582 I have found those shown to be entirely satisfactory. Of course, all dimensions not indicated are the same as those shown in the SUPPLEMENT mentioned.

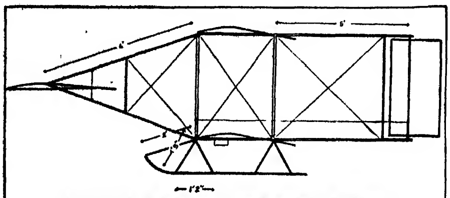


Fig. 1.—Side view showing the construction of the glider.

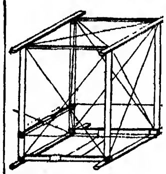


Fig. 2.—The sliding seat and rudder controls.

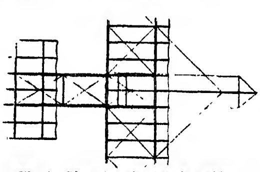
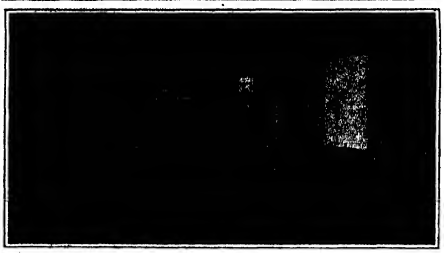
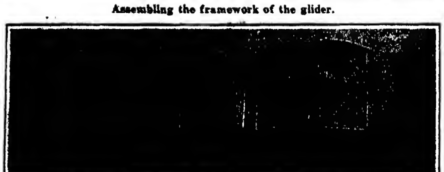


Fig. 3.—Plan view showing the rudder connections.



Assembling the framework of the glider.



The glider at the instant of landing.

The Function of a University

IN an address at Columbia University opening exercises by F. J. E. Woodbridge, Ph.D., dean of the graduate faculty, the speaker said that while mind is man's natural possession, the discovery of its use and significance in his life is a genuine discovery which enlarges his vision, begets the sense of a new and unlimited power, and gives him a new confidence. An historian might claim that the discovery marks the important crisis of civilization. It is set down as one of the striking events which characterized the beginning of what we call modern times. Yet it is not something incident to an artificial period of time. It is the one event which makes it possible to regard the past as antiquity—the sum of things accomplished—to view the present as opportunity, and to see the future ahead. It is not a characteristic of modernity, but its essence.

Schools exist because the mind has been discovered. Their obvious purpose is to keep us acquainted with the mind and to promote the intelligent penetration of things. If this is true, then the discovery of the mind should be the source of our educational programmes and the criterion by which they should be judged. Are we making intelligence prevail? Are we invading with the spirit of inquiry every department of life? Are we letting no chance slip to bring under the control of reason the least as well as the greatest undertakings of men? Of such a type are the questions which those who believe that mind has been discovered will ask; and they will insist that their labors be judged by the standards such questions suggest and by no others.

Such questions determine the point of view from which the rapid expansion of our universities should be regarded. It is short-sighted to see in this expansion principally the abandoning of what is old and tried and the rushing into what is new and popular. We hear of "new ideas of a university," but in strictness of speech—or one might say, metaphysically—there can be no new idea of a university which is not a wrong idea. For there is something Platonic and eternal about that idea, a changeless essence which may shine through many changing things. The only sense in which it can be called new is the sense in which we indicate that some one has seen it for the first time in his own experience. There may be new courses, new methods, and new degrees, and these may displace older and long established institutions, but there can be no new university. The accidents are old or new, the substance never; for the idea of the university is the idea of the organized discovery of the mind.

The university is, therefore, not simply a place where a number of people are engaged in teaching and being taught a number of subjects of greater or less importance. It is much more than a collection of different schools brought together under one administration for purposes of economy or size. It is much more than a haphazard arrangement of different courses leading to different degrees and framed to meet demands of the moment, or to illustrate passing fashions, or to compete with rivals. To see no more is to see with myopic vision. To be sensible of no more is to be insensible to opportunity. The university is always at the beginning of a greater career when it finds a region which intelligence can invade and master, for that means progress in organizing the mind's discovery. It looks with a jealous eye on every educational enterprise and every attempt to advance learning which seeks an independent existence.

We should enhance the belief that the university is in idea, and shall be increasingly in practice, the most important of human institutions. It sets faith in the controlling power of the mind in contrast with faith in any other power. It insists that a technique of curiosity, criticism, and control is superior to every other kind of technique, because it is applicable to every undertaking. It demands, since there is always an intelligent and rational way of doing what needs doing, that that way be found and followed, not only in mathematics and philosophy, in literature and science, in industry and the arts, but also in public life, in business, in politics, in society, in morals, and in religion. The proposition that we must think one way in the cloister, but must live and behave a different way in the market, is to it intolerable. The notion that we are the products of our ancestry, it supplements with the notion that we are the ancestors of posterity, making us thus indebted to the past, but obliged to the future. It aims to be the place to which men can look for judgments which are disinterested and, therefore, just. It is content only as it sees ignorance, prejudice, passion, partisanship, superstition, and privilege progressively giving place to the life of reason.

History may be read in terms of politics, or of economic forces, or as an evolution. It may also be read in terms of the discovery of the mind. We may see man rising from the ground startled by the first dim intimation that the things and forces about him are convertible and controllable. Curiosity excites him, but he is subdued by an untrained imagination. The things that frighten him, he tries to frighten. He would scare the earth's shadow from the moon and sacrifice his dearest to a propitious sky. It avails not. But the little things teach him and discipline his imagination. He has kicked the stone that bruised him only to be bruised again. So he converts the stone into a weapon and begins the subjugation of the world singing a song of triumph by the way. Such is his history in epitome—a blunder, a conversion, a conquest, and a song. That sequence he will repeat in greater things. He will repeat it yet and rejoice where he now despairs, converting the chaos of his social, political, industrial, and emotional life into wholesome force. He will sing again. But the discovery of the mind comes first, and then the song

1849. Harlem Railroad car, drawn by horses, passing the Tombs Prison.

Monumental Gateway to a Great City

Completing the Grand Central Terminal, New York

[illegible]

IN tracing the history of that great system of railroads known as the New York Central Lines, we must go back to the year 1832 in time, and in place to the City Hall Park, New York city. Here, on Center Street, was built the small terminal station of the New York and Harlem Railroad, whose double tracks were carried down Park Avenue and Center Street to a point near the City Hall. The cars were not nearly so large as, nor did they approach in comfort, our present street cars, and the locomotives could have been comfortably stowed within the firebox of the largest locomotive of the present day. The City Hall station was in the uptown district of the city of those days, but during the first two decades of the operation of the road, the growth of population and traffic northward on Manhattan Island, necessitated the construction of a new terminal farther uptown, and in the late fifties a new station was built at Twenty-sixth Street and Fourth Avenue on the present site of Madison Square Garden. The new structure was considered to be one of the notable buildings of the city of that day; yet it is a fact that it could be set down in the express concourse of the station of 1912, without touching the walls or reaching the roof above. In 1857 the use of steam locomotives south of Forty-second Street was discontinued and for many years the cars were hauled to the City Hall and back by teams of horses. So rapid was the growth of the city, however, and the increase in the traffic, that the company decided to build at Forty-second Street a large terminal, to be known as the Grand Central Station; and, profiting by the experience of the past, they determined to construct both the yard and the train sheds on a scale of magnitude that would accommodate the traffic of the road for many a decade to come.

The present New York Central and Hudson River System was organized by Commodore Vanderbilt in the year 1869, and in the same year the construction of the first Grand Central Station was begun. Two years later it was opened to the public. The train shed, the largest, by far, that had ever been built in the United States, was covered in by a single arched roof, 200 feet in span and 600 feet in length. Within it, fifteen tracks were accommodated and during every twenty-four hours eighty-eight trains entered and left the station. During the first year of operation four millions of people made use of the new terminal.

Twenty-five years later the traffic had increased so greatly that the station had to be enlarged. Additional tracks were laid and the capacity of the building was increased by adding three stories above the old structure. This work was done in the year 1900. Scarcely was the improvement completed, however, before it began to prove inadequate.

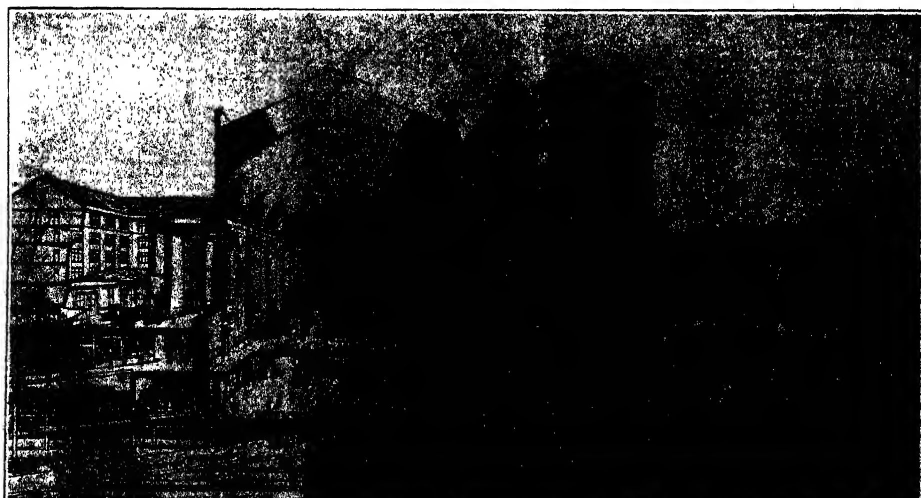
Demand for Greater Facilities.

It now became clearly manifest to the management of the New York Central Railroad that, if adequate provision was to be made for the increase of the future,

Apologia

Architecture being a reasoned art, for any specified purpose there should be precedent and tradition—every motive and element should have its reason for being, and in all compositions, no matter how simple, the elements must explain themselves and justify their presence. In ancient times the entrance to the city was through an opening in the walls or fortifications. This portal was usually decorated and elaborated into an Arch of Triumph, erected to some naval or military victory, or to the glory of some great personage. The city of to-day has no wall surrounding that may serve, by elaboration, as a pretext to such glorification, but none the less, the gateway must exist, and in the case of New York and other cities, it is through a tunnel which discharges the human flow in the very center of the town. Such is the Grand Central Terminal, and the motive of its façade is an attempt to offer a tribute to the glory of commerce as exemplified by that institution. The architectural composition consists of three great portals crowned by a sculptural group, the whole to stand as a monument to the glory of commerce as typified by Mercury, supported by moral and mental energy—Hercules and Minerva. All to attest that this great enterprise has grown and exists not merely from the wealth expended, nor by the revenue derived, but by the brain and brawn constantly concentrated upon its development for nearly a century.

WHITNEY WARREN.



At the left are the express and suburban platforms, with inclines leading to the respective concourses, waiting rooms and [illegible]. At the right are the [illegible] Interborough, Hudson and Manhattan, and Belmont tunnels, by which the traffic is distributed throughout Greater New York and Jersey City.

General sectional view of the Grand Central Terminal.

[illegible] of the entire reconstruction of the station [illegible] and the terminal building upon a vastly greater [illegible] and the adoption of an entirely new principle, [illegible] in the movement of the trains and the handling of the outgoing and incoming traffic, would [illegible] the conditions. Two factors in particular had to be reckoned with. One was the unparalleled rate of growth of the population of New York and its suburbs, and another was the growing popularity of the outlying districts for residence and the consequent enormous increase in suburban traffic. How greatly this has grown is shown by the estimate that, at the present time, nearly one and a quarter million people enter New York daily from within a radius of twenty-five to thirty miles. A large portion of this inflow finds its way through the Grand Central Terminal; and it is necessary to handle it, night and morning, expeditiously and with convenience both to the public and the railroad companies, whose heavy service of express through trains must not be hindered.

The Traffic Problem.

In order to realize the difficulties which confronted the company in meeting existing conditions, it should be understood that all the trains which enter the Grand Central Terminal have to pass through a four-track tunnel, running below Park Avenue to Fifty-sixth Street, where the tracks diverge into the terminal yard. Under previous methods of operation, the trains ran into what are known as "dead-end" tracks, under the train shed, where the passengers disembarked. The empty cars had then to be drawn back to Mott Haven, to the north of the Harlem River, for cleaning and preparing for the next trip; after which they had to be drawn again through the tunnel into the terminal. It is evident that this arrangement practically doubled the train movements through the tunnel; or, in other words, exactly halved its capacity for passenger service. For some years it had been recognized that the ideal arrangement would be to remove the storage and cleaning yard at Mott Haven to the terminal at Forty-second Street. This, however, would have necessitated a great increase in the size of the yard and large purchases of real estate at high prices. Outside of the objection on the score of the great cost was the even more serious one of the noise, dust and smoke occasioned by the presence of an ever-increasing number of steam locomotives in the very heart of the city. The solution of the problem came, as it so often does in human affairs, in an unexpected way and from an unlooked for quarter. For there can be no question that the serious collision in the tunnel, near the terminal yard, in January, 1902, occasioned by the failure of the engineer of a train to see the smoke-and-steam-obscured signals, was the predisposing cause which led, ultimately, to the erection of the present magnificent terminal station and yard. The accident resulted in legislation at Albany, which required the railroad, after a certain date, to substitute electrical for steam operation through the Park Avenue tunnel.

Electric Operation and "Air Rights."

When the New York Central Railroad Company found themselves confronted with the problem of electrifying their terminal lines and station, it was realized that they had before them a task of great difficulty, involving new problems and calling for the most careful deliberation. It was at once determined to take advantage of the situation by building a new terminal on a scale of size and magnificence which had never been approached in any other terminal station in the world. This point being settled, the question arose as to how to secure the additional space necessary. The purchase of the twelve or fifteen city blocks that would be required would have involved a staggering outlay of money, which, added to the cost of electrification and of the great terminal structures which were contemplated, raised the total estimate of cost to a figure which even this wealthy corporation could not contemplate without some dismay. It was at this juncture that the chief engineer of the road, Mr. W. J. Wilgus, submitted to President Newman an alternative scheme, the merits of which were quickly appreciated and received the necessary indorsement. The plan was to utilize the "air rights" above the existing station yard, by placing the new yard and platforms entirely below the street level; roofing the tracks over; restoring the intersecting streets to city use; and utilizing the forty-six acres covered by the yard, by renting out the many blocks thus rendered available, for the construction of hotels, apartment houses, clubs and such other buildings as might be determined upon. The comparative estimate of the cost of a surface as against a subsurface station, showed that excavating below ground and building above ground, and thereby utilizing to the full the air rights, would yield to the company such large rentals that a good return would be realized, even upon the vast amount of capital invested.

Direct Versus Alternating Current.

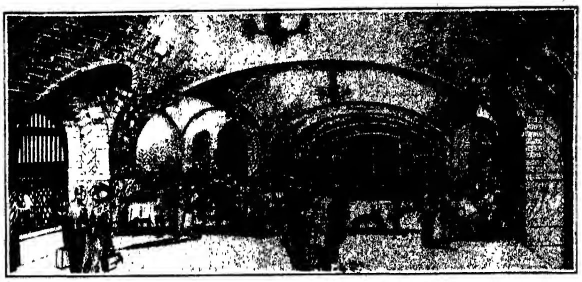
The substitution of electrical for steam traction having made it possible to utilize the air rights by building a terminal yard and station entirely below street level, the important question presented itself as to what system of electric traction would best meet the conditions. President Newman quickly realized how vital a question this was. There was no precedent whatever to go upon. The conditions were new; the problem quite untried. Moreover, at this time there were two great rival systems of electric traction in the field, the direct current and the alternating current. Very wisely, President Newman organized a special board of electrical and engineering experts to thrash out the question. They did so; and it took them two years to come to their final conclusion that, all things considered, the direct-current, third-rail system would best meet the conditions. The New York, New Haven and Hartford Company also have their terminal at the Grand Central Station. The management determined to electrify their main lines as far as Stamford, Conn., and after mature consideration, they decided to adopt the alternating-current, high-tension system, using 11,000 volts in an overhead line. The New

Express concourse; a noble hall, 120 by 272 feet, finished in Botticino marble.

The general waiting room, capable of accommodating five thousand people.

[illegible] To the left is a completed section of the express level. In the center excavation is in progress. To the right is a section of the old yards. To the rear are the new post office building and the old train shed.

Three stages in the construction.



The restaurant with its fine vaulted ceiling.

York Central suburban electric zone was to extend thirty-four miles to Croton on the main line and thirty miles to White Plains on the Harlem. The direct-current system has the advantages that the third rail affords a more compact and ship-shape system of construction; that the pressure is lower; and that the risks of accident are reduced practically to the vanishing point. The company have done the electrical world great service by publishing very complete details of the original cost, cost of operation, and the risks and accidents of operation, thereby placing the art of steam, trunk-line electrification in possession of a large amount of very useful data. The New Haven Company has also published the facts as to convenience of operation, reduction of train movements, etc., but, unfortunately, they have been absolutely silent on the all-important question of the relative total cost of operation by the alternating-current system, as compared with that of operation under steam. It is sincerely to be hoped that these important data will soon be forthcoming.

Some Facts and Figures.

Just here, before describing the work of building the yard and station, it will be well to give some facts and figures showing the magnitude of the task with which the architects and engineers were confronted. In the first place, the total area of the station is seventy acres, which is exactly two and one half times as great as that of the next largest station, the Pennsylvania Terminal, Manhattan, which covers twenty-eight acres. It is over seven times as large as the area of

Comparative Statement—Principal Passenger Stations in the United States and Europe.

	Total Area, Acres	Length Track, Miles	Number of Tracks	Number of Platforms
New Grand Central Terminal	70 0	31 8	46*	30
Pennsylvania, N. Y. City	28 0	16 0	21	11
Chicago & Northwestern, Chicago	8 0	2 7	16	8
St. Louis Union Station	10 9	5 4	32	16
Boston South Station	9 2	15 0	32	10
Washington, Union Station	13 0		20	13
Cologne	5 8	3 4	14	9
London, Waterloo Station	8 75		18	
Dresden, Main Station	7 0	3 0	14	8
Paris, St. Lazare	11 2	3 5	31	14
Frankfort Main Station	11 0		18	9

* Of the total 68 tracks these 46 have platforms

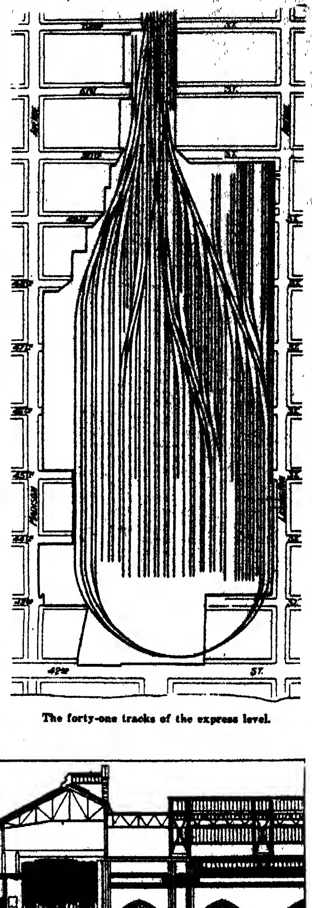
the Boston South Station, and over six times the size of the Frankfort Main Station in Europe. It has a total of sixty-eight tracks, of which forty-six have platforms, as against twenty-one tracks in the Pennsylvania Terminal, thirty-two in Boston and St. Louis Stations, and eighteen in the Frankfort Main Station. The work of placing the two levels of the station below ground involved the excavation of three million cubic yards of material, chiefly rock, and hauling it away for a distance of from ten to thirty-five miles from the station. Thirty-two miles of track had to be laid. The old station of steel, glass and stone had to be removed. In the construction of the roof of the suburban level, the viaducts at the cross streets and at Park Avenue and the Main Building, there had to be erected no less than one hundred and eighteen thousand six hundred tons of steel work. This is over twice as much steel as was used in the construction of the existing subway in New York city and Brooklyn.

The fireproofing of the terminal—incasing the steel work and building floors and partitions—called for 1,700,000 square feet of terra cotta hollow tile.

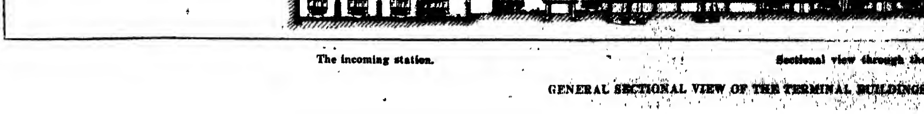
This constitutes a gigantic task of construction under any circumstances; but when we bear in mind that the whole of this work of pulling down, of excavating, of building up, had to be done either below or by the side of the constantly-moving traffic of one of the greatest railway terminals in the world, and to be done without any interference whatever with that traffic, it will be admitted that the approaching successful completion of this great work reflects the highest credit upon every one concerned in its execution—management, engineers, architects, contractors, and the operating staff of the railroad terminal. Americans are justly proud of their engineering achievements in works of great magnitude, and among these the building of the world's largest terminal under such exceptional difficulties must always remain one of the most notable.

The Engineering Problem.

Briefly stated, the engineering problem was to remove the old train shed and terminal building; to excavate the whole forty-six and a half acres to an average depth of 45 feet; to erect in the excavated area, the massive columns and floor beams for carrying the express level tracks (a construction involving over sixty thousand tons of steel); to erect above this the viaduct and cross streets, restoring the original thoroughfares for use by the city; to tear down and remove the old train shed with its extensive terminal building for office and general station uses; to erect the present magnificent structure, in which are housed the principal offices of the company and the various concourses, waiting rooms, etc., of the terminal; to lay down the thirty-two miles of track in the yard and station; and to do all of this without interfering with the regular operation of the trains running into and out of the station. The plan of construction adopted and so successfully carried through was to commence excavation on the easterly or Lexington Avenue side; and, as fast as the work was



The forty-one tracks of the express level.

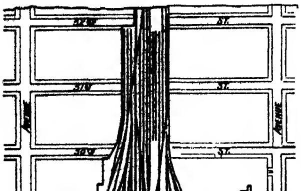


The incoming station.

Sectional view through the

GENERAL SECTIONAL VIEW OF THE TERMINAL BUILDINGS

…arried down to grade, to erect upon it the steel work for the two new levels, lay the tracks upon it, and transfer the trains gradually from the old to the new levels. This plan has been followed out with great success. We draw attention to the view of the work on page 485, taken while it was in full swing, which shows at the left a completed section of the station yard



The twenty-seven tracks of the suburban level.

The suburban concourse, reached by the gentle incline to the left.

and tracks with electric trains standing upon them. In the center is the work of excavation, and to the right a section of the original yard. In the background, to the left, is shown the new post office building, in which are housed also a great many of the managing and clerical offices of the railroad. In the center is the old station train shed and terminal building. The work has progressed gradually from east to west, and to-day the remaining excavation below Vanderbilt Avenue is being pushed to completion.

A New Civic Center.

By referring to our front page engraving, it will be seen that for the present, the station yard tracks will be exposed to view in the area north of the station; ultimately, however, these spaces will be covered by buildings designed to present as far as possible a monumental effect; and it is probable that the buildings will include museums, hotels, business blocks, theaters, clubs and other structures which admit of bold architectural treatment on a large scale. If the present plans are carried out, the buildings will be erected by the Railroad Company and leased for a long term, probably ninety-nine years. The cost of the buildings will be repaid to the company in yearly installments. Such a plan has the great advantage that the railroad company can reserve the right to exercise a strict supervision over the architectural features of the building, which, as far as possible, will be of classical or semi-classical treatment. A unique and highly commendable feature is the fact that, when the thirty-two blocks of the station site have been built over, they will contain but two chimneys—these being the two smokestacks of the terminal power house, situated in one corner of the site, at Fiftieth Street and Lexington Avenue. All light and heat for the buildings will be furnished from this power house. Ultimately, when the whole area shall have been covered in, there will rise upon the site of the old and unsightly yard with its smoke and dirt and noise, a new section of the city, which in the dignity and harmony of its architecture will be unequaled in any part of Greater New York.

The Design of the Terminal Building.

It is probable that no building in ancient or modern times has been made the subject of such an exhaustive study as the new Grand Central Terminal. Two prominent firms of architects in this city, Messrs. Warren & Wetmore and Messrs. Reed & Stem, have collaborated in the work. To the former firm is due the broad outlines of the design and what might be termed the general æsthetic treatment of the subject, while the latter firm are responsible for what might be called the engineer-architect feature of the work. There is a general consensus of public opinion that this collaboration has resulted in a building of which the city may justly be proud. Among the great terminal stations of the world, we know of none that surpasses this in the conformity of its architecture to the purposes of the building. The general effect is one of great dignity and beauty, and the decorative features have been so judiciously applied that they fulfill their proper purpose of accentuating the principal architectural elements of the structure rather than, as is so often the case, detracting from them.

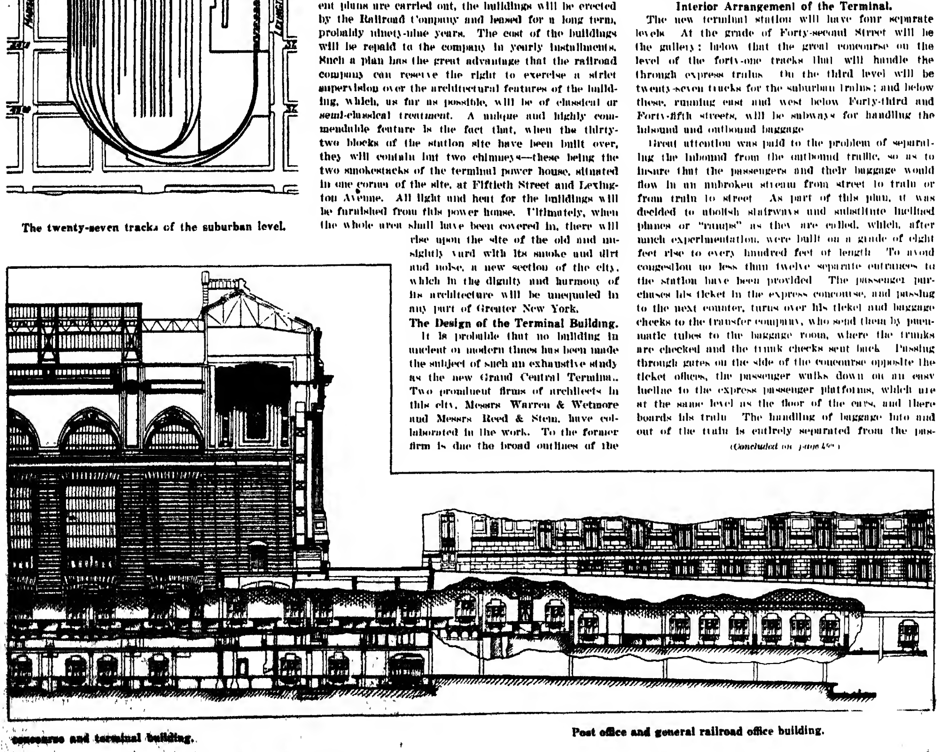
As forming the commercial gateway for a great system of railways to the heart of the country's greatest city, the Forty-second Street façade, crowned by its imposing group of statuary, must be pronounced a notable architectural success.

Interior Arrangement of the Terminal.

The new terminal station will have four separate levels. At the grade of Forty-second Street will be the gallery; below that the great concourse on the level of the forty-one tracks that will handle the through express trains. On the third level will be twenty-seven tracks for the suburban trains; and below these, running east and west below Forty-third and Forty-fifth streets, will be subways for handling the inbound and outbound baggage.

Great attention was paid to the problem of separating the inbound from the outbound traffic, so as to insure that the passengers and their baggage would flow in an unbroken stream from street to train or from train to street. As part of this plan, it was decided to abolish stairways and substitute inclined planes or "ramps" as they are called, which, after much experimentation, were built on a grade of eight feet rise to every hundred feet of length. To avoid congestion no less than twelve separate entrances to the station have been provided. The passenger purchases his ticket in the express concourse, and passing to the next counter, turns over his ticket and baggage checks to the transfer company, who send them by pneumatic tubes to the baggage room, where the trunks are checked and the trunk checks sent back. Passing through gates on the side of the concourse opposite the ticket offices, the passenger walks down on an easy incline to the express passenger platforms, which are at the same level as the floor of the cars, and there boards his train. The handling of baggage into and out of the train is entirely separated from the pas-

(Concluded on page 4…)

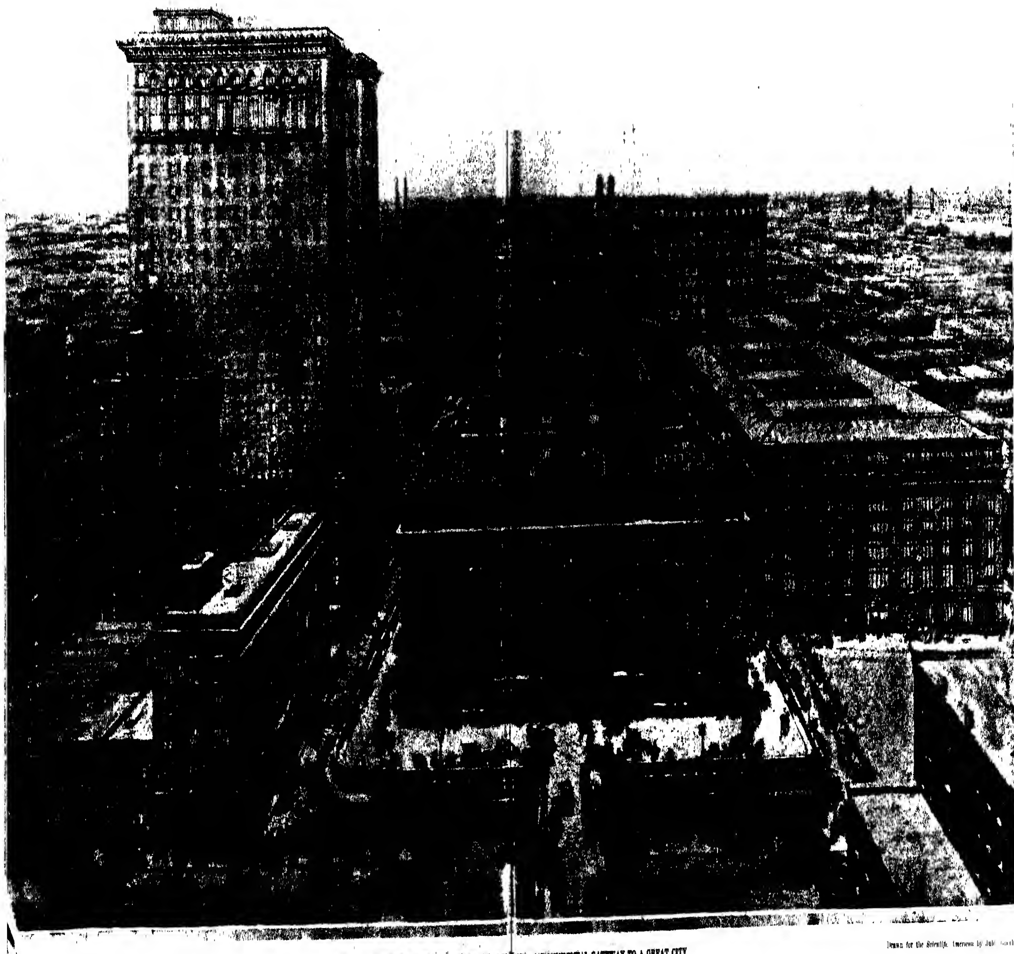


…concourse and terminal building.

Post office and general railroad office building.

…AND TRACKS OF THE GRAND CENTRAL TERMINAL

oerin.



THE GRAND CENTRAL TERMINAL GROUP OF BUILDINGS—A MONUMENTAL GATEWAY TO A GREAT CITY

Drawn for the *Scientific American* by Jules Guérin

Inventions New and Interesting

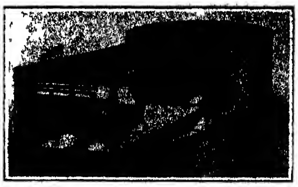
Simple Patent Law; Patent Office News; Notes on Trademarks

The Hen Her Own Bookkeeper

NO matter how shrewd at sizing up a hen he may think he is, no poultryman can tell with any degree of certainty which are his best layers without keeping an actual record of the laying. As in other walks of life the credit is quite liable to go to the occasional layer but constant cackler while the quiet industrious hen is badly misjudged. In order to determine how much dependence can be put in the judgment of a poultryman, a careful record was kept at an experiment farm in Minnesota. In very few cases did the estimate tally even approximately with the actual work of the hen. One hen which was estimated to lay 270 eggs laid as a matter of fact only 80 in the year; another hen rated at 208 per year laid only 40. On the other hand a hen with an 80-egg reputation laid 152, while one estimated to lay 60 actually laid 134. The figures as reported from this experiment station show that it is absolutely necessary for a poultryman to keep accurate records. Otherwise he cannot weed out the poor layers from the good, but must let the lazy hen continue to eat up the profits of the others. Also, not knowing the mother of the egg, how can the poultryman breed good layers and prize poultry? An accurate pedigree is impossible without constant and tedious watching.

After cogitating on this matter for some time two

Entering the nest and springing the gate-trigger.



Crawling out of the nest and registering her autograph.

A battery of four nests one with the gates down

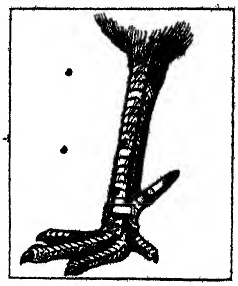
Staten Island poultrymen conceived the idea of letting the hen keep her own record. They tried out the scheme and found that it worked to perfection. The idea was so novel that they were surprised when applying for a patent to find that many others had been endeavoring to devise some scheme for keeping an automatic record of the hen's work. However, while having the same object in view, their methods were entirely different. Some of the patented recording nests were so intricate and required so much of the hen that no self-respecting fowl would enter them. However, the apparatus devised by these two inventors calls for no work on the part of the hen until she leaves the nest, and then all that she has to do is to stoop under a gate that partially closes the entrance. By so doing she registers her autograph on a piece of paper.

As shown in the drawing, the hen walks up an inclined board to the nest. In so doing she strikes a trigger that releases two gates, which drop down and bar the entrance to any other hen. The inner gate is hung high enough to permit the hen to crawl under it. This is no hardship for the fowl which no doubt has been educated to crawl under fences. But in squatting so as to crawl under the gate, the hen is obliged to bring a crayon strapped to her leg into contact with a piece of paper on the inclined board, thus leaving her autograph after passing out of the nest. The outer gate is easily negotiated, for it consists of a light wire frame that swings outward readily enough. However, this frame will not swing inward and so acts as a bar against the entrance of any other hens to the nest. The inclined board is mounted on a spring at its inner end so as to make the nest adaptable to hens of various sizes. After the egg has been laid the nest remains closed until the poultryman arrives to reset the gate and remove the egg and autograph record of the hen. To distinguish between hens, each is provided with an individual color, and if there are not colors enough to go round, combinations of colors are provided, for a hen may wear a crayon on each leg. The crayon holders, as shown in the drawing, are secured like the steel spurs of the fighting cock and are made of aluminium. They are so light and fit so well that the hen does not notice them any more than one notices the ring on his finger. It has been found that the crayons last from six to eight weeks without any attention whatever. Although the device may strike us as amusing because of its novelty, it has clearly proved its efficiency and is being extensively introduced among poultrymen.

A Mechanical Eye for Burglar Protection

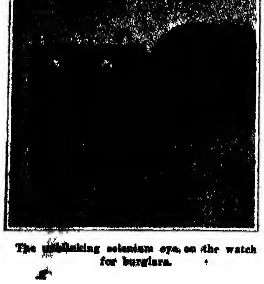
A FRENCH inventor has recently designed a burglar alarm which is a very close mechanical substitute for a human watchman. The device is arranged to operate before the slightest injury has been inflicted upon a safe by a burglar. In fact, it has no material contact with its surroundings, for it includes the mechanical equivalent of an eye which will detect the faint light from a dark lantern or even a match, hence making it a good fire alarm as well as a burglar alarm. As our readers have probably guessed, the "mechanical eye" is a selenium cell, such as used in picture-telegraphing apparatus, for the reason that the electrical conductivity of selenium varies approximately with the amount of light that falls on it. The mechanical eye consists of a cylindrical box, four inches in diameter, and about an inch thick, containing a band of selenium wound up in a coil. There is one of these boxes for each room that it is to be protected, but they all communicate their sensations of light by electricity to a common receiver, which is designed as follows.

In the field of a large horseshoe magnet is suspended a thin wire, about a foot in length. This carries a very light rectangular aluminium frame, wound with a galvanometer wire. The galvanometer coil A weighs about an ounce and has an electrical resistance of five thousand ohms. One terminal of the coil dips into

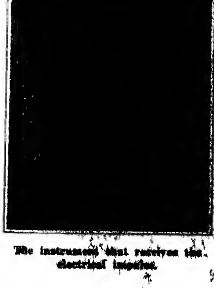


The aluminium crayon-holder on the hen's leg.

a cup of mercury B, while the other connects with the suspension wire. The transmitter or mechanical eye D is placed in circuit with battery E, coil A and mercury cup B. When a ray of light falls on the cell D it varies the strength of the current passing through the coil A, causing it to turn, bringing its lower terminal into contact with one or other of the set-screws F and thereby closing a relay circuit containing the alarm gong G. The sensitiveness of the receiver may be varied by adjusting the screws F. The alarm bell is actuated through the intermediary of a "jack" similar to that used in telephone switchboards, so that once the circuit is closed the bell will continue to ring until it is stopped by throwing a switch. Equipped with this alarm apparatus the good man of the house can slumber in peace, confident that the unblinking selenium eye

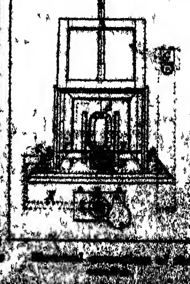


The unblinking selenium eye, on the watch for burglars.



The instrument that receives the electrical impulse.

The receiver on [illegible]



[illegible]

We believe that orders for nearly every 1913 Cadillac will be placed before winter is half over

The Cadillac has enjoyed many successful, many extraordinary seasons.

1913 is eclipsing all former successes.

Never in its history has Cadillac enthusiasm been so strong, so widespread, so pervasive as now.

The new car has literally taken the country by storm.

The handsome lines, the deep soft upholstery, the yielding springs, the riding qualities of almost velvety smoothness; the quiet engine of abundant power, the flexibility and the remarkable ease of control; the standardization of parts, the durability, the simplicity and the economy of maintenance; the practically 100 per cent efficient Cadillac Delco electrical system of automatic self-cranking and electric lighting, *now in its second successful year on the Cadillac;* these and almost countless other marks of distinction, stamp the Cadillac as a car which leaves nothing to be desired, nothing really worth while which a greater expenditure will procure.

The Cadillac production is large—15,000 cars for 1913—just one of the great elements which make possible the Cadillac car at the Cadillac price.

Before the new model was announced, dealers had contracted for this entire enormous output. They had also placed orders for several thousand more, our acceptance of these additional orders being conditional upon our being able by some means to supply them.

Without seeing the car or even its photograph, more than 3,000 individual purchasers placed their signed orders. They had confidence in the Cadillac car and in the Cadillac Company.

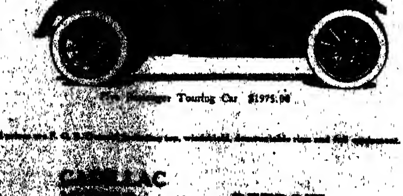
Four thousand of the new cars which have already been delivered have vastly intensified the early enthusiasm. They are proving that the confidence was not misplaced. They are confirming the wisdom of those who placed their orders in advance.

Nearly everyone you meet is—to use a common expression—"Sold on the Cadillac." There seems to be almost none left who are not convinced of Cadillac pre-eminence.

As we said at the outset: We believe that orders for nearly every 1913 Cadillac—including those for spring and summer deliveries—will be placed before winter is half over.

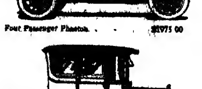
It behooves you, therefore, to arrange for as early a delivery as your dealer can give you.

By heeding this advice—given you in all sincerity—you will avoid disappointment. You will also avoid the necessity of compromising on some other car—a proceeding which almost invariably results in an unsatisfied longing in the mind of the man who has once concluded that the Cadillac is the car he *wants.*

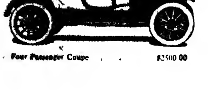


Touring Car $1975.00

Four Passenger Torpedo . . . $1975.00



Four Passenger Phaeton . . . $1975 00



Four Passenger Coupe . . . $2500 00

CADILLAC MOTOR CAR CO. DETROIT, MICHIGAN

will keep an unremitting watch on his safe or his silver chest. But the eye possesses a failing common to all mechanical substitutes for human agencies. It cannot distinguish between right and wrong. When it sees a light it sounds the alarm regardless of what that light may be. The inventor explains that during the day time the mechanical eye is closed by a lid, but he does not explain what occurs in the early morning. Presumably the alarm is sounded at "peep" of dawn. But perhaps he has some clock mechanism to close the eyelids just before daybreak.

Simplifying Court Procedure in Patent Cases

NEARLY all the witnesses before the House Committee on Patents upon the hearings on the Oldfield bill for the revision of the patent law, and all the writers who have discussed patents in the SCIENTIFIC AMERICAN and SUPPLEMENT, agree that the patent laws of the United States, so far as they define the rights of patent owners, are fundamentally sound, but that all the imperfections which have been imputed to the patent law can be traced to matters of practice and procedure. How such improvements can be effected, without any action on the part of Congress, but simply by act of the courts themselves, has been strikingly illustrated during the past few months.

So notable have been the changes in practice and procedure accomplished by the courts themselves, during the past few months, that it can safely be said that by these changes more has been accomplished to insure perfect operation of the patent laws than would have been accomplished had all the proposals for changing the patent system which have been agitated with increasing fervor in Congress during the past few years been enacted and carried into execution.

The first change related to an evil which patent lawyers have frequently commented on and which lay at the bottom of the case of Westinghouse Company v. Wagner Company, 173 Fed., 361. In that case the Court of Appeals for the Eighth Circuit had affirmed a rule under which all an infringer has to do to secure himself against a recovery of profits is to add something of his own to the complainant's device, a thing which can be easily done in almost any case.

On June 7th, 1912, however, without waiting for any amendments to the law, the Supreme Court of the United States upon an appeal from the case above cited, Westinghouse Electric and Manufacturing Company v. Wagner Electric and Manufacturing Company (225 U. S., 604), reversed the decree of the Circuit Court of Appeals. By this decision of the Supreme Court the following propositions of law became established: If the infringer has sold or used a patented article, the patentee is entitled to recover all of the profits. If a patent, though using old elements, gives the entire value to the combination, the patentee is entitled to recover from an infringer all the profits. If profits are made by using an article patented as an entirety, the infringer is liable for all the profits, unless he can show, and the burden is on him, that the profits are partly the result of some other things used by him. If the infringer, however, by commingling the elements renders it impossible for the patentee to meet the requirement of apportionment, the entire inseparable profit must be given to the patentee. In such a case, as in that of a trustee *ex maleficio* confusing gains, the loss should fall on the guilty and not on the innocent. This rule applies even if the patented device infringed did not preponderate the creation of profits. The owner of a small profit of a fund is equally entitled to protection as the owner of a larger share. While the rule applied may ultimately shift the burden so as to cast it on the defendant, it is justly cast upon one who should bear it, as he wrought the confusion. These rules, be it noted, have [illegible] law by the decision of the [illegible] Court of the United States without the [illegible]

INQUIRY COLUMN

Inquiry No. 9286. Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289. Wanted substance melting at 225° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor.

Inquiry No. 9290. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292. Wanted a gum that will stick labels to grape-fruit.

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth.

of resorting to any amendment of the patent laws by act of Congress or otherwise.

The other changes which have corrected the practice and procedure under the patent law in the chief respects in which they have been criticised, were accomplished on November 4th, 1912, by the Supreme Court of the United States, when the Court promulgated its Revised Rules of Practice for the Courts of Equity of the United States.

The chief criticism directed against the existing patent system has always been that in patent litigation testimony was ordinarily taken, not in court before a judge, whose good offices could be relied upon to expedite the trial, but out of court before an examiner, who was powerless to control the length of the examination or the prolixity of the testimony. Thus, it was possible to expand the testimony to unseemly length and thus interpose intolerable delays, and well-nigh prohibitive expense upon the weaker litigant. There was also the possibility that even after this enormous bulk of testimony had eventually been passed upon by the court and a decree made thereon, the Appellate Court might reverse the decree and send the whole cause back for a new trial, involving a repetition of the same tedious performance. How this has been revolutionised by the New Rules promulgated by the Supreme Court appears from several of the Rules themselves.

New Rule 46, relating to trials, requires that testimony shall, except in extraordinary cases, be taken in open court. "In all trials in equity," says New Rule 46, "the testimony of witnesses shall be taken orally in open court, except as otherwise provided by statute or these rules. The Court shall pass upon the admissibility of all evidence offered as in actions at law When evidence is offered and excluded, and the party against whom the ruling is made excepts thereto at the time, the Court shall take and report so much thereof, or make such a statement respecting it, as will clearly show the character of the evidence, the form in which it was offered, the objection made, the ruling, and the exception. If the Appellate Court shall be of opinion that the evidence should have been admitted, it shall not reverse the decree unless it be clearly of opinion that material prejudice will result from an affirmance, in which event it shall direct such further steps as justice may require."

New Rule 47 is even more explicit: "The court, upon application of either party, when allowed by statute, or for good and exceptional cause for departing from the general rule, to be shown by affidavit, may permit the deposition of named witnesses, to be used before the court or upon a reference to a master, to be taken before an examiner or other named officer, upon the notice and terms specified in the order. All depositions taken under a statute, or under any such order of the Court, shall be taken and filed as follows, unless otherwise ordered by the Court or judge for good cause shown. Those of the plaintiff within sixty days from the time the cause is at issue; those of the defendant within thirty days from the expiration of the time for the filing of plaintiff's depositions; and rebutting depositions by either party within twenty days after the time for taking original depositions expires."

New Rule 48 deals directly with the sorest subject of patent practice, namely, the testimony of expert witnesses in patent and trade-mark causes. "In a case involving the validity or scope of a patent or trade-mark," says the rule, "the District Court may, upon petition, order that the testimony in chief of expert witnesses, whose testimony is directed to matters of opinion, be set forth in affidavits and filed as follows: Those of the plaintiff within forty days after the cause is at issue; those of the defendant within twenty days after [illegible] time has expired; and rebutting affidavits within fifteen days after the [illegible] of the time for filing [illegible]. Should the [illegible] party [illegible] the pro-

...ection of any affiant for cross-examination, the Court or judge shall, on motion, direct that said cross-examination and any re-examination take place before the Court upon the trial, and unless the affiant is produced and submits to cross-examination in compliance with such direction, his affidavit shall not be used as evidence in the cause."

The seal of the Supreme Court of the United States to prevent prolixity of testimony and undue expansion of the record appears throughout the New Rules. Thus, depositions before an examiner are expressly permitted to be in narrative form instead of in question and answer. (New Rule 49.) No transcript of evidence before the examiner can include argument or debate. (New Rule 51.)

"The evidence to be included in the record (on appeal) shall not be set forth in full, but shall be stated in simple and condensed form, all parts not essential to the decision of the questions presented by the appeal being omitted and the testimony of witnesses being stated only in narrative form, save that if either party desires it, and the Court or judge so directs, any part of the testimony shall be reproduced in the exact words of the witness." (New Rule 75.)

"In preparing the transcript on an appeal, especial care shall be taken to avoid the inclusion of more than one copy of the same paper and to exclude the formal and immaterial parts of all exhibits, documents and other papers included therein; and for any infraction of this or any kindred rule the Appellate Court may withhold or impose costs as the circumstances of the case and the discouragement of like infractions in the future may require. Costs for such an infraction may be imposed upon offending solicitors as well as parties." (New Rule 76.)

The determination of the Supreme Court to stamp out the common devices by which patent litigation has heretofore been made burdensome is notably expressed in the rule last quoted.

The way of the procrastinator in patent litigation will hereafter be hard. "After the time has elapsed," says New Rule 56, "for taking and filing depositions under these rules, the case shall be placed on the trial calendar. Thereafter no further testimony by deposition shall be taken except for some strong reason shown by affidavit. In every such application the reason why the testimony of the witness cannot be had only on the trial, and why his deposition has not been before taken, shall be set forth, together with the testimony which it is expected the witness will give."

"After a cause shall be placed on the trial calendar," says New Rule 57, "it may be passed over to another day of the same term, by consent of counsel or order of the Court, but shall not be continued beyond the term save in exceptional cases by order of the Court upon good cause shown by affidavit and upon such terms as the Court shall in its discretion impose. Continuances beyond the term by consent of the parties shall be allowed on condition that only a stipulation be signed by counsel for all the parties and that all costs incurred theretofore be paid. Thereupon an order shall be entered, dropping the case from the trial calendar, subject to reinstatement within one year upon application to the Court by either party, in which event it shall be heard at the earliest convenient day. If not so reinstated within one year, the suit shall be dismissed without prejudice to a new one."

The New Rules above quoted will go into effect February 1st, 1913. Alone, and without the necessity of any amendment in the law, they have removed the chief grounds for criticism of the existing patent system. Still more important, they point the way to similar changes in practice which the Patent Office, itself, without the necessity of any act of Congress, may effect in the Patent Office. Finally, they illustrate the futility of seeking, by fundamental changes in the patent system and radical abridgment of the rights of patent owners, to accomplish reforms

which so easily and so completely can be effected without resorting to ...

The Limitations of Firearms Silencing

By Hiram Percy Maxim

A VERY interesting play now running in New York depicts a murder by means of a silent-shooting pistol. The different scenes where the pistol is used are most impressive and interesting but as many people are bound to get an altogether mistaken notion of what can be done in real life with a firearms silencer, it seems worth while to point out some little known information on the subject

In the play a crook is supposed to have acquired a pistol with a silencer attached to it He demonstrates it to his friend by actually shooting at a vase of flowers standing on a table He smashes the vase, or at least, the vase is smashed and there is no noise from the pistol Later on in committing a burglary he is betrayed by one of his supposed pals. He shoots his betrayer noiselessly with this pistol while the police are waiting in the next room and escapes The police are entirely ignorant of what has occurred. The impression given is that all the real crook need do in order to duplicate in real life what he saw on the stage, is to buy a silencer and attach it to his pistol and go ahead. Fortunately this is not at all the case, as can be easily seen from a moment s glance of any pistol.

There are two forms of pistols in use to-day One is the revolver and the other is the automatic pistol. These are the only hand arms which can be secreted and used by the law breaker with any chance of escaping detection Let us see what happens when we try to silence one of these weapons. The revolver has a cylinder usually carrying six cartridges. This cylinder is revolved by pulling the trigger the cartridges being successively brought up to a position opposite the barrel ready for firing The loose joint between the cylinder and the barrel is jumped by the bullet Of course a serious gas leakage occurs at this joint but we have grown accustomed to this and never think of it Now suppose we attach a silencer to the muzzle of this revolver The silencer checks the powder gases and holds them Obviously these gases, imprisoned in the barrel and silencer make their escape at the joint between the cylinder and the barrel already referred to Instead of there being a flash of fire at the muzzle of the barrel there is one at the joint The revolver makes as much noise with the silencer as without it

The writer has had several interesting experiences in demonstrating this matter before legislative bodies A few States have considered passing laws prohibiting the use of any device for lessening the noise of firearms, and in many cases the writer has been asked to appear at hearings and show why such laws are not only based upon mistaken ideas, but also why they would be harmful to our many rifle and target shooters At these hearings a rifle a revolver and a Maxim silencer have been used The silencer was adapted so it could be fitted to a revolver or rifle. A box of sand made a safe bulletstop. The rifle w uld be fired first with the silencer to show that the silencer would silence The device would then be placed upon the re olver and one half of those present would be asked to turn their backs and listen to the shots, both with the silencer and without and to say which was which Those not turning their backs were to see that the experiment was free from all question The revolver with the silencer would be emptied into the sand box, then reloaded the silencer attached and emptied again Then the gentlemen with backs turned would be asked which was which. In no case has it been the writer s experience that the gentlemen were unanimous. Much amusement has always followed. Why any one at all familiar with the revolver should imagine that it could be silenced ... is a surprising thing in itself.

Now let us turn to ...

the automatic pistol. This weapon is constructed so that when a cartridge is exploded, the breech immediately opens, ejects the empty shell, throws in the new cartridge and closes the breech again. The recoil performs all these functions. If we attach a silencer to the muzzle of one of these automatic pistols, the powder gases are caught and imprisoned, and when the automatic breech opens, these imprisoned gases are released and blow out backward, sometimes into the face of the shooter. It makes a very dangerous experiment and should never be attempted by those unfamiliar with firearms.

This is why we have no murders by crooks using silencers, except upon the stage. The only weapon with which the silencer really works is the rifle. But even in the rifle there are several important limitations. These concern the noise made by a bullet in its flight through the air, and is a subject which has been touched upon by the writer in the SCIENTIFIC AMERICAN in the past. This article is not quite complete without reference to it. When the rifle bullet travels at a velocity less than 1,100 feet per second, its flight is noiseless, practically speaking. If, however, the velocity exceeds this figure, its flight makes a noise sounding precisely like the crack of a whiplash. Indeed, that which causes the whiplash to "crack" is what causes the bullet to "crack."

A bullet or a whiplash or any other object moving through the air is like a boat sailing through the water. It creates a "bow wave" which trails off to the rear and outwardly. When the velocity of a bullet or other object exceeds a certain amount, this bow wave begins to *break*, *exactly* the same as the bow wave from a boat breaks when the boat exceeds its characteristic speed. The breaking of a water wave makes a splashing sound. The breaking of an air wave makes a cracking sound. We never heard it until we silenced the gun.

Another very curious thing is the fact that this "breaking" of the wave seems to occur when the bullet acquires the velocity of sound. Any velocity below this appears to be quiet, while any velocity above this makes the noise. The dividing line appears to be a very sharp one.

Thus, even on a rifle, a silencer cannot give absolutely noiseless shooting if ammunition is used which has a bullet velocity in excess of 1,100 feet per second. The silencer will eliminate absolutely the report noise made at the muzzle of the gun, but it cannot of course control the noise that may be made by the bullet in its flight out beyond the gun. Generally speaking, the only standard rifle ammunition for sale which has a bullet velocity *less than 1,100 feet per second* is the 0.22 caliber, for the popular small target shooting rifle. All larger than this have bullet velocities which *exceed 1,100 feet per second.* Shooting to be noiseless enough for the assassin would then be limited to the 0.22 caliber and also to the use of a rifle. This is obviously impractical for the purposes of crime. On the other hand, not only the 0.22 caliber, but all the other calibers are immensely increased in value to the target shooter by a silencer. Not only is the 0.22 caliber made quiet enough so that target practice can be held without creating disturbance, but all the larger calibers can be shot with an entire absence of report concussion and a reduction of 75 per cent of the recoil. As a means of teaching high power rifle shooting, the silencer is indispensable. The United States Government adopted it because its value in instructing recruits is equal to its value in time of war.

Thus, we see that the firearms silencer has limitations. This will spoil many sensational stories and newspaper editorials, but it is nevertheless a fact. There is no way in which the criminal can ever make his revolver or automatic pistol noiseless.

A New Gun for Throwing Bombs and Life Lines

(Concluded from page ...)

...of the circular ... on the ... The proper

elevation could then be given to the bomb gun, at each shot, by bringing the bubble to the position thus determined. In the improved types now constructed the spring gun is replaced by a system of sights provided with mirrors, which reflect the image of the target, through a reticle to the eye of the gunner.

In attacking a place defended by firearms the gunner is protected by a sheet of chrome steel with hinged and adjustable end pieces. This shield, which is large enough to shelter several men, is mounted on two wheels and is easily moved, even over rough ground and small obstacles.

The inventor has employed this gun to throw a perforated bomb containing asphyxiating liquids and powders. A detonator, immersed in the mass, is exploded by a wick which is ignited by the combustion of the firing charge. In experiments conducted in the presence of the prefect of police and other officials a room more than three hundred feet distant from the gun, was made uninhabitable in a few seconds.

For fighting fire, the gun is charged with five or six pounds of a dry powder which quickly extinguishes an incipient conflagration, even if it has already become too hot to be approached. The extinction is certain in a confined space. It is less certain in the open air, if only one gun is used, but two or more guns fired simultaneously or in rapid succession are reasonably sure to accomplish the desired result. The powder, projected in a closed room, confines the flames within a small space, extinguishes them in its passage and covers the embers with a coating that excludes the air and disengages gases which prevent combustion. The efficacy of the process is due to the simultaneous action of the powder on all parts of the fire. The blast of powder attains a diameter of 10 or 12 feet at a distance of 25 feet from the gun, and covers an area of 200 square feet.

The Mathiot gun is well adapted for throwing life-lines. The barrel of the gun has a longitudinal groove to receive the line attached to the projectile, and the line is in no danger of being cut, frayed or ruptured, as the pressure and the initial velocity are small, although a long range can be obtained with a sufficiently heavy projectile. The construction of the projectile varies according to the special conditions of its use. It is usually made of wood, but it may be made of iron, with an air chamber in front to give it buoyancy in water. Some projectiles are of the rocket type and propel themselves by the steady burning of a fuse or by successive explosions.

Finally, the Mathiot gun may advantageously be employed in war for throwing small bombs of various kinds to a moderate distance with a very satisfactory degree of precision.

How Electricity Makes the Dairy Cleaner

(Concluded from page 402.)

ing; but later on electricity was introduced for lighting in the cow stables, creamery and horse stables.

In the interior views of the cow stable the electric lamp bulbs may be just distinguished, as they are close up to the ceiling and are set in watertight fixtures.

Consideration of all conditions that may point the way toward "cleaner" milk is desirable from the fact that our State and municipal authorities have not yet fully realized the gravity of the situation generally. There are, to be sure, several dairy farms such as here described, where milk is produced for commercial use under conditions that are practically perfect. But considerable of the milk still used is not prepared in this way, and unless "pasteurized" it of necessity is an injurious food, particularly for infants and children—the greatest milk consumers.

It is a well-established belief among those in a position to know, that tuberculosis, typhoid and scarlet fevers and diphtheria can be transmitted to human be-

ings through the drinking of raw milk in which these germs exist. Consequently, the welfare of the future generation depends upon the methods employed to-day in safeguarding our milk supply. The improvement in dairy conditions during the past few years has been marked, and is a result of the greater dissemination of knowledge as to the seriousness of carelessness in the preparation and handling of milk as a food product. During the last year or two there has been a striking decrease in the infant mortality in those places where milk conditions are under careful surveillance. Many lives have been saved and numerous chances of disease avoided by more careful attention to the health of the dairymen, as well as of the cows, and the handling of the milk at the farm, in transportation, and distribution.

The introduction of electricity on the dairy farm requires a better class of labor. The devices need a little skill in their handling. Such apparatus, however, simplifies labor conditions, and fewer persons, where the work is done by electricity, will accomplish the same or greater work. Improvements of this character must necessarily make for better conditions and are desirable not alone for their commercial gain, but because they are a benefit to humanity.

It can no longer be doubted that dairy products—and this term includes milk, cream, ice cream, butter and cheese—are excellent vehicles for the dissemination of pathogenic bacteria. Outbreaks of typhoid fever, scarlet fever, diphtheria, sore throat and intestinal disorders of children have been definitely traced to contaminated milk. The proofs of the danger of tuberculosis infection from these products are accumulating daily. The opportunities for such infection are manifold. With the greatest vigilance on the part of the trained inspectors and the best care on the part of the consumer, this infection cannot be entirely prevented.

Of course, the carrying out of the recommendations for the production of more sanitary milk, entails additional expense at the farm. But the receipt of a single additional cent per quart of milk would justify many improvements in the average dairy. A single case of sickness from contaminated milk would cost far more than the slight additional price of better milk for a long period.

It is both interesting and important, however, to note that where electric systems are properly planned and correctly installed they invariably result in decreased cost of operation, if one is careful to include all proper costs when making the comparison; and this statement holds good no matter whether it be applied to the subject of electric power or to lighting only. There are some conditions under which an exception might be made for other reasons, as for instance, where live steam is near at hand. For sterilizing purposes it might be needed in any event. Such cases, therefore, must be determined on their merits. As a general rule, the use of electricity in the dairy will result in economy of operation; and, as an element of modern dairy equipment, it suggests the greatest single influence toward increased cleanliness.

Monumental Gateway to a Great City

(Concluded from page 487.)

sengers, the incoming baggage being unloaded beyond where the passengers leave the train, and the outgoing baggage being brought up to the baggage cars at the front of the train, from the subways already alluded to. In agreement with the principle of complete segregation of the various classes of passengers, there are two large waiting rooms adjoining the Forty-second Street entrances, one for through long-distance passengers, and another immediately below it for suburban service; each being on the level of the track which it serves. Everything—ticket offices, entrances, and exits to the express and suburban service, will be entirely distinct and separate, each having

its own concourse, its own information bureau, its own baggage checking places, parcel room, and other facilities for travel. The concourse for inbound trains can comfortably hold eight thousand people; that for outbound trains, fifteen thousand. The waiting room will accommodate about five thousand more; and altogether this great station can take care of nearly thirty thousand people, without subjecting them to uncomfortable crowding. It is estimated that seventy thousand outbound passengers can pass through the terminal in an hour; which is double the maximum carrying power of any passenger station existing to-day.

Great Train Capacity.

The great train capacity of the station, estimated at a maximum of two hundred trains an hour, is due to the introduction of the loop system, both for express and suburban service. Instead of trains coming in, discharging passengers and backing out, they will continue, when empty, around a loop under the southerly front of the station; and then will run over to the yard at one side of the station yard, where they will be cleaned and made ready for the next trip. It may be mentioned here that not only has electricity rendered possible this underground and entirely enclosed station, but it has cut out a large amount of switching.

All-electric Signal System.

Mention should be made of the all-electric signal system, the only one of its kind in the United States. The main signal tower is a four-story building, below street level, in which are housed the interlocking machines by which the signals and switches are operated. The machine for the suburban level is the largest ever built; it contains four hundred levers, and on the floor above is a machine with three hundred and sixty-two levers, operating the switches and signals on the express level. The movement of the trains is indicated by little electric lights on a chart which is a fac-simile of the track layout of the yard The switches and signals are, of course, interlocked. Altogether in the whole yard there are over one thousand separate levers. Attention is drawn to the fact that, when the gate to the train platform is closed, its shutting gives an electric signal, not only to the train, but to the signal towers clear up the main line—an arrangement which will save minutes of time over the old method.

In conclusion, note should be made of the sectional view of the new terminal station, which is shown on page 484 of this issue, and more particularly we direct attention to the lower right hand section of the drawing, in which is shown the remarkable concentration of subway, street surface and elevated lines, which occurs at the new terminal on Forty-second Street. Passengers, on arriving in New York will find themselves in immediate touch with half a dozen distinct lines of transportation by elevated railway, surface car, or subway as the case may be. From the terminal any section of Greater New York may be reached—in most cases without change of cars. At street level, running past the entrance to the terminals, are the surface cars of several of the main lines of travel north and south through the avenues, and east and west through the streets of the city. Above these is the terminal station of a short branch of the elevated system, which puts the passenger in touch with the east side system of elevated roads throughout the length of Manhattan and the Bronx. Immediately below street level is the four-track express subway of the Interborough Company; and below that will be the new subway of the Hudson and Manhattan Railway by which passengers can proceed direct to the terminals of the western railroads which enter Jersey City. Below that, again, is the Belmont tunnel to Long Island. Broad inclined planes and spacious footways will enable passengers to proceed direct from their trains to anyone of the three subways, the surface cars, or the elevated trains.

In all probability the Grand Central

Terminal will always remain the most extensive and in every way the most notable terminal station in the world. That it will for all time prove sufficient to meet the growing traffic of the future no one for a moment believes. Some day the growth of the city and the ever-swelling tide of travel will have overtaken and swamped even this great structure. When that time comes, entirely new adjustments will have to be made, and, possibly, the great terminal of to-day will be replaced by one north of the Harlem River—a suggestion, by the way, which came up for discussion when the plans of the present terminal were being considered.

Paris Wireless and the Time of Day

By the Paris Correspondent of the Scientific American

THE International Time Conference recently finished its work at the Paris Observatory, which was chosen for the meetings, and some resolutions of interest were decided. One of the principal decisions is that all the researches made in different observatories all over the world as concerns the determining, preserving and transmission of time, are to be henceforth centralized at Paris. A competitor for such a horary center was the powerful German wireless telegraph station of Norddeich which, like the Eiffel Tower, is now engaged in sending out regular time signals each night, but the German delegation finally entered into the present agreement. The choice of Paris as a center point is due among others to the use of the Eiffel Tower for wireless signaling as being the highest in the world, and also to the established reputation of the observatory, one of whose eminent members, M. Ch. Nordmann, supplied me with the present information.

Besides the tower, whose signals carry for nearly 4,000 miles at present, but which is not sufficient for more distant points, there are chosen a certain number of other stations encircling the globe, and all these will be regulated according to the tower plant. Each station in turn will serve as a center for sending out time signals over a given radius, these to be sent at different hours of the day so as not to interfere with each other. When all the stations are working it is not too much to say that all points on the earth's surface will receive time signals twice a day at least, for the use of navigators, explorers, surveyors, railroads, scientific stations, clockmakers and the like, giving the exact time within one tenth of a second. It was decided that the time in all cases is to be based on the Greenwich meridian as a standard, to which it is easy to bring the local time at any spot by astronomical observations. In this way navigators are able to find their bearings no matter what station may be sending the time signals, by referring to the chart. The stations which are chosen by the conference to act as time signal stations are as follows, and accompanying each is the figure for Greenwich time, which each one will send out. For this there is used the new 24-hour time notation, starting from midnight as usual, but counting 24 hours for the entire day up to the following midnight. Thus 3 o'clock P. M. is now 15 hours, etc. Stations: Paris, midnight and 10 hours; San Fernando, Brazil, 2 and 16 hours; Arlington, U. S. A., 3 and 17 hours; Mogadiscio (Somali region) and Manila, 4 hours; Timbuctoo, 6 hours; Norddeich, Germany (the great wireless station), noon and 22 hours; Massaouh (Erythrea), 18 hours; San Francisco, 20 hours. However, it should be stated that these decisions are of a scientific but not a governmental order, and it is now required that each of the respective governments enter into the scheme. No doubt this will follow, as it is now recognized that the wireless time signals will have a great practical value.

The Tenth International Congress of Agriculture will be held at Ghent, Belgium, June 8th to 13th, 1913. The general secretary is M. Paul de Vuyst, director-general of the Rural Office in Brussels.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Of General Interest.

MEANS FOR PACKING FRESH PINEAPPLES.—H B. KOPP, P. O. Box 1286, New Haven, Conn. This invention has particular reference to means or method of packing fresh pineapples which may have become substantially ripe before being gathered, whereby they may be shipped with safety and whereby the highest market prices are attainable.

EQUILIBRATOR.—MELVIN VANIMAN, deceased, care of Gustav Blasing, 2 Rector St., New York N. Y. This invention relates to a combined equilibrator and ballast, more applicable to aeronautic devices, and an object of the invention is to provide means for quickly raising water-ballast to the aeronautic ship while sailing over the water, which may, if desired, be used as a drag The device of the indicated character is provided, which, in passing through the water, will offer a minimum resistance to the movements of the aeronautic ship

LOOSE LEAF BINDER.—J T BRINK, Station C, 414 Broadway Ave, Topeka, and H. NORDSTROM, Topeka, Kan The purpose of the invention is to provide a new and improved form of loose leaf binder constructed so as to be of substantially unlimited capacity, and capable of quick and easy opening and closing for inserting or removing leaves.

TRANSOM LIFTER.—J H GARTNER, 631 South Main St, Pocatello, Idaho In this case a vertically slidable rod is employed, but the upper end of the same is connected with the transom proper by means of a spring, which is held slidably in a curved guide attached to the door casing; and the rod is operated, that is, adjusted vertically, and locked in any position, by improved means.

INVALID'S BODY SUPPORT.—E. S. WEAVER, P O. Box 8, Arapahoe, N. C. An object here is to provide a device by means of which a person, such as a paralytic, who is deprived of the use of some of his limbs, may be enabled to support his body and even to walk Further to provide a device by means of which a leg which has been paralyzed or otherwise rendered unable to support the body may be moved so as to aid in walking

OILER.—R H EVANS, care of Grand Central Hotel Nelson, Riondel, British Columbia, Canada This invention provides an apparatus wherein provision is made for the exclusion of extraneous matter, such as grit, dust or water; provides means for insuring the supply of oil when desired, to avoid leakage of oil from the apparatus, to insure the steady delivery of oil during the use of the oiler; and to provide means for locking the device in sealed position, to prevent the delivery of oil therefrom

Heating and Lighting.

GAS BURNER.—W N BEST, SR., 11 Broadway, New York, N Y The special aim of this inventor is to so construct the burner that the combustible gas after escaping will become mixed with air and burn closely adjacent the surface of the refractory material, which last will retain the heat and facilitate the combustion

METHOD OF PRODUCING LAMP CHIMNEYS.—W J WAMBAUGH, Box 723 Morgantown, W Va The object here is to produce a chimney having an ornamental top which does not require a relative thickness of glass at the top, but in which the top and body of the chimney are of uniform thickness, thus doing away with the excess of breakage due to unequal expansion and contraction of the relatively thick top and thin body.

TUBE SCRAPER.—M J. THORSEN, 824 Park Ave, Weehawken, N J The invention has reference generally to boiler tube scrapers and more particularly is directed to a device designed to more thoroughly and effectively clean such tubes in the manner designed to prevent the material scraped from the tube from becoming wedged therein and clogging the same

GAS GENERATOR.—R. C. BRADLEY, 837 De Sird St, Shreveport, La. An object here is to provide a light, compact, and easily transportable device especially designed for use with prepared cartridges, and having means for moving the cartridge into or out of the water, and for sealing the cartridge in a holder when not in action.

Household Utilities.

WASHBOARD.—MARTHA A. MORSE, 230 Keap St, Brooklyn, N. Y. The object here is to provide an improved means for retaining the soap or other cleaning agent that may be used, in convenient position, with a view to its ready application by the user to the cloth, which is being rubbed upon the board for the purpose of cleaning the same.

EXTENSION TABLE.—S. R. LIBBEY, Cottonwood, Idaho. The invention provides a table having disappearing leaves which may be brought into or out of place by the act of pulling the ends of the table apart or pushing them together. Novel means provide for raising the leaves into place or for causing their disappearance.

Machines and Mechanical Devices.

POWER TRANSMITTING DEVICE.—J. W. STOKER, 612 E Harrison St., Marion, Ind. An object in this case is to provide a device for increasing power, which is made of few parts and is not liable to get out of order. A further purpose is to provide a device arranged so that by a slight change the ratio of the increase of power may be varied.

DAVIT.—O E KNORR, care of Hans Bugge, 407 Sunset Bldg., Bellingham, Wash. This davit may be quickly operated to extend outward a track on which the supporting carriage may travel, the means for extending outward the track, and for supporting the carriage on the track after it is extended, being operable by a single member under the control of one man.

GRAIN ELEVATOR.—R. L. MAPSON, La Mesa, Cal. This invention provides a conveyor and elevator adapted to be disposed at a plurality of angles relatively to one another, by means of which grain may be conveyed from a plurality of positions to be fed into a threshing machine which remains stationary, there being means connected with the threshing machine adapted for driving the elevator and conveyer.

APPARATUS FOR ISSUING OR DELIVERING TICKETS AND OTHER ARTICLES.—G. I. F. SOULAGE, 44 Rue Chanzy, Paris, France. In this invention the actuation of the devices in withdrawing the ticket or other article at the same time actuates an apparatus which adds the price of the ticket withdrawn to the total value of the tickets previously registered. The apparatus therefore comprises a delivery apparatus, and adding apparatus for totalizing the value of the tickets issued.

MOLD.—W. J. BOYD, SR., care of H. Anderson, McLeansboro, Ill. This mold has a frame with two sprocket wheels, one journaled at each end, with sproket chains disposed around the sproket wheels, and connected with fulcrum members mounted to slide on the frame so that when one of the sprocket wheels is rotated the fulcrum members will be moved relatively to the frame, and the arms which are pivotally connected with the fulcrum members, and with the mold-side members will be moved to push the last into position.

WEB OR FILM FEEDING MECHANISM.—J. URIE, care of L. G. Erb, 1062 Clay Ave., New York, N. Y. This inventor provides a mechanism, which permits proper feeding of the web or film and at the same time allows an accurate taking or projecting of pictures without jerk or jar of the film or web, thus avoiding the usual flicker of the picture projected on the screen.

Prime Movers and Their Accessories.

AUTOMATIC STEAM FEED AND PISTON ROD SUPPORT.—W. VAN DER LEAST, Nespit, Wis. The object of this invention is to provide a steam feed and piston rod support for use in the steam feed cylinder, for supporting the piston rod to prevent sagging and consequent wear on the packings and loss of power.

PRESSURE GAGE.—E. J. HAVERLY, Sayre, Pa. This invention relates generally to pressure gages and more particularly to an adjustable means of connection between the expansible element and the intermediate actuating devices for the pointer. The construction and arrangement of the parts are such that adjustments may be made without dismantling the gage.

CARBURETER.—L. SLIGER, 2305 Delware St., Indianapolis, Ind. The objects of this invention are to more thoroughly atomize the hydro-carbon liquid, to maintain hydro-carbon spray as near as practicable centrally in relation to the atomizing chamber through which it is forced to the engine throttle, to heat the atomizing chamber by aid of waste engine gases; to adopt the carbureter in connection with a variable damper, to provide an arrangement for controlling the needle valve in atomizing, and to provide an adjustable float within the apparatus.

PRESSURE GAGE.—J. OKILL, 30 Highfield Grove, Rock Ferry, Cheshire, England. This invention relates to pressure gages, and has for its purpose to construct a simple and convenient gage for measurement of the maximum pressure attained in fluctuating or pulsating pressure such as is produced in the cylinders of internal combustion engines.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical, and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We are prepared to render opinions as to validity or infringement of patents, or with regard to conflicts arising in trade mark and unfair competition matters.

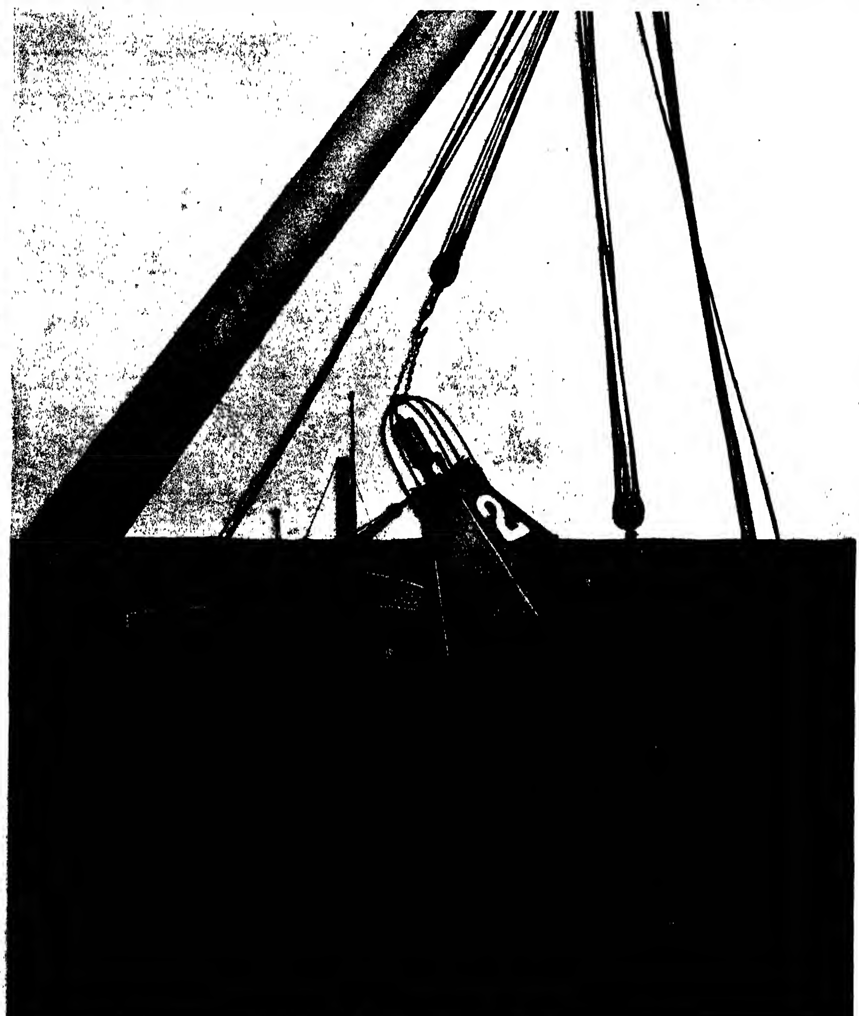
We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 24.] NEW YORK, DECEMBER 14, 1912 [PRICE 10 CENTS $3.00 A YEAR



The dangerous work of hauling the enormously large and unwieldy iron buoy over the side of the tender.

WORKING A WHISTLER.—[See page 514.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, DECEMBER 14, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year . . . . Postage prepaid in United States and possessions Mexico Cuba, and Panama	$3.00
Subscriptions for Foreign Countries one year, postage prepaid,	4.50
Subscriptions for Canada, one year, postage prepaid.	3.75

The Scientific American Publications

Scientific American (established 1845) . . . . per year,	$3.00
Scientific American Supplement (established 1876) "	5.00
American Homes and Gardens . . . . "	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic* the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Solving the Pier Problem

THE recent action of the Board of Estimate of this city, in the matter of pier extension, advances the question a long way toward a satisfactory solution. The Board approved the plans for constructing piers of 1,000 to 1,200 feet length, between Forty-fourth and Fifty-sixth streets, by making the necessary excavation inshore. It also approved the plan for straightening the pierhead line between the Battery and Thirtieth Street; a relocation which would permit the construction between these points of a score of piers from 920 to 1,040 feet in length. These improvements are those suggested by the Terminal Committee of the Board of Estimate and by a State board appointed by Governor Dix. A copy of the report and the resolution of the Board of Estimate have been forwarded to Mr. Stimson, the Secretary of War, with whom the determination of pierhead lines finally rests.

The two plans are complementary, and both are, or will prove to be, necessary to meet the demands of future shipping. The extension and straightening of the pierhead line will give immediate relief, and make it possible to build ships of 900 to 1,000 feet length, without anxiety as to the question of dock accommodation.

Nobody can place any exact limit upon the size of future steamships—provided, always provided, that the deepening of entrance channels keeps pace with the ship's ever-deepening draft. It is now fairly certain that the year 1913 will see the laying down of the keel of the first 1,000-foot ship; and the economic conditions which justify the 1,000-foot ship encourage the shipping people to build one 1,100, 1,200 or even 1,500 feet in length; for the larger the ship the smaller the cost of carrying the individual passenger or a given amount of freight. But when the Secretary of War has sanctioned the pierline extension from the Battery to Thirtieth Street, he will have defined the least navigable width of the Hudson River for all time. Any ship that exceeds 1,040 feet (the length of the longest pier admissible within the new line) must tie up at piers which have secured the needed length by excavating back beyond the shoreline.

Hence the great importance of the Board of Estimate's plan for obtaining possession of the present rather unimportant stretch of piers between Forty-fourth and Fifty-sixth streets, together with sufficient land for the construction of 1,000-foot or even longer piers by excavating back into Manhattan. For it may be taken for granted that the giant ships of the future will ask for docking facilities, not at Boston, New London, or Montauk, not even at South Brooklyn, but at Manhattan; and the city will have failed to learn the lesson of the present *impasse* if it omits to make provision for a growth in the size of ships which is certain to take place.

Hence, we suggest that while the city is making the necessary purchases of land in the uptown district, it acquire the whole depth of the blocks between Forty-fourth and Fifty-sixth streets, from Twelfth to Eleventh avenues. This would give accommodation for piers 1,500 feet deep, and for the terminal buildings and marginal elevated road, proposed by Dock Commissioner Tomkins.

The piers would be built in numbers and length, only as needed, and it might be two decades or more before the 1,500-foot ship appeared; but he would be a bold prophet who, turning from the 100 per cent increase of length of the past quarter of a century would deny a 50 per cent increase in the quarter of a century to come.

An Admirable Civic Body

IN fulfilling its avowed purpose of recording the world's progress in scientific knowledge and industrial achievement, the SCIENTIFIC AMERICAN has always given much attention to important engineering works of a municipal character. In the course of our investigations, we have noticed how frequently—we had almost said invariably—our study of large municipal problems has brought us sooner or later, and generally sooner than later, into touch with that admirable body, the Merchants' Association of New York.

Which means, of course, that this body of high-minded citizens for many years past has been doing well its work of safeguarding and promoting the interests of the commercial capitol of the western hemisphere. The Association has been both watchdog and worker. It has always been the terror of the spoilsman, whether he was represented by a powerful political law-juggling clique at Albany, by the dishonest contractor for city works of great magnitude, or by the innumerable petty larceny grafters which follow in the train of the generals and captains in the work of municipal spoliation.

The Merchants' Association has rendered its many services to the city so quietly, that we believe the average citizen has no adequate conception of the extent and importance of the work, both of prohibition and promotion, which it has done. Its membership is made up of well-known, influential and high-minded citizens of New York. In every big civic question which has arisen, or at least in those of a scientific, technical or constructive character, such as come within the province of this journal, the attitude of the Merchants' Association has invariably, if our memory serves us right, been the one which seemed to this journal to be for the best interests of the city.

The record of work accomplished by the Association is a long one, and its successes have been notable. There comes to our mind the winning fight, which was so ably waged by this body against that attempted colossal fraud of the Ramapo watershed. But for the work of the Association, a band of rapacious politicians would have committed this city to a system of water supply, the sources of which would have been held for ransom by the members of the band themselves. The scheme was exposed and frustrated, and out of this agitation has ultimately come the construction of the magnificent Catskill waters supply, which is soon to be at the city's disposal.

Another successful agitation was that which secured, in the face of political and interested opposition, the passage of the Pennsylvania tunnel franchise, which to-day is yielding a considerable annual revenue to the city. To the Association is due, in no small degree, the federal appropriation of six million dollars for the dredging of the 40-foot channel into New York harbor, which is now practically completed. But for this channel, the modern liners of vast length and draft which now enter this harbor must have sought some other port of call.

Not alone was the Association the original moving power which led to the enlargement of the Erie Canal; but it was largely instrumental in securing the canal terminals, which are necessary if the city is to reap the benefit of that great work. Moreover, the Association had much to do with the passage of the legislation providing for the elevated freight tracks along the Hudson River waterfront, associated with suitable terminals, at which all railroads could deliver their freight.

In this connection, mention should be made of the protective influence of the Association, as shown in their successful efforts to induce the federal government and the State of New York to join in a suit to prevent the State of New Jersey from discharging the sewage of the Passaic Valley into New York harbor.

The Merchants' Association realizes that the approaching construction of the Panama and Erie canals, and the unparalleled growth of the city in population, wealth and trade, to say nothing of the active rivalry of other seaports, calls for a proportionate increase of activity in so meeting the new conditions as to promote the best interests of the city. The Association wishes to broaden the field of its operations, and it is looking for the more active support of the prominent and influential citizens of New York. One of the encouraging signs of the time is the increasing recognition of the demands of citizenship upon the voluntary services of the individual citizen. Within the ranks of the Merchants' Association he will find both the organization and the means for giving practical expression to his desire for the political and commercial improvement of the city.

Selling Patented Articles

THE recent decision of the United States Supreme Court in the Dick Mimeograph Patent Case, and the widely quoted dissenting opinion of Chief Justice White from this decision is the chief occasion for the present passion to change the patent system.

Almost everybody who read Chief Justice White's dissenting opinion was imbued with the idea that the defendant, Henry, who made the ink that caused all the trouble, was held as a patent infringer, because Miss Skou, the girl who owned the mimeograph which was misused, bought some of Henry's ink and used it without poor Henry's ever knowing anything about it.

The truth is that Dick's mimeograph was sold only upon condition that it be used exclusively with Dick's ink. Henry, knowing all about this license restriction, and with the expectation and intention that his ink would be used for the purpose of violating this restriction—to which Miss Skou, as Henry well knew, had expressly assented when she acquired the mimeograph—supplied Miss Skou with the means of accomplishing this wrongful act. Indeed, the courts below expressly found that Henry, *far from acting* with that innocence which has captured the popular fancy, had deliberately and knowingly instigated Miss Skou to this wrongful act, and had even instructed her that if she would pour Henry's ink into Dick's can, and then throw away Henry's can, so that no one would find it, she would never be caught violating the license restriction!

It is a peculiarity of patented articles, as many manufacturers and inventors explained to a congressional committee as soon as they had the chance, that they are essentially new and unfamiliar. The patent owner can control them only during the seventeen years that the patent endures. All the resources of past experience in advanced salesmanship are none too adequate to market a new and unfamiliar patented article, the use of which may mean a decided change in the personal habits of a large portion of the public.

In the rather colloquially expressed opinion of one authority, who testified before the congressional committee in question:

> "The mere invention of merchandise is almost a minor consideration when put up against the selling and marketing of merchandise. There are thousands of inventions in this country which are very valuable indeed, but which can never be commercial possibilities or are not now commercial possibilities because of the selling problems involved. There are big and serious selling problems involved in merchandise, especially patented merchandise. *If you are selling shoes*, there is a ready and accepted market for shoes, before you manufacture, but when you take a patented article, think what you are up against! You have got to persuade the other man to whom you hope to sell that this is a good thing, something that he has never used before. It may mean a revolution of his habits, or it may be a revolution of something else, and you have got to overcome that resistance."

If the patented article depends for its successful operation upon the use of supplies especially adapted to it, the difficulties are immensely increased. "It may be," explained a member of the Inventor's Guild, "that the article is of such nature that in order that it shall work properly, it shall require very great care in selecting certain conditions of use, certain materials to be used in connection with it. It certainly is a fact, that, in some instances, a man with a market for a good article would be completely destroyed, if he could not insure himself in seeing that it was properly used after it left his hands."

Mr. H. Ward Leonard, a former associate of Mr. Edison's and now a famous electrical inventor on his own account, was asked, when he appeared, whether the self-interest of the customer was a not sufficient substitute for any license restriction. He replied:

> "I cannot agree, that that would be sufficient protection to the manufacturer whose sale depends entirely upon the *perfect performance* universally of the article. I have been a manufacturer long enough to know that there is nothing which so insures your future business of a profit as universally high quality, and it only takes a few cases that are spread abroad by your competitors as to the improper working of an article to have a very serious effect upon your business."

The chief obstacle in the marketing of an untried patented article is always the initial expense of its purchase price. The price, in any sum that fairly compensates the patent owner, is, in many cases, too high to sell the article. To avoid this obstacle, and so far as possible to relieve this additional expense, various plans have been devised, under which the customer pays for the use of the patented article, only after he has actually used it, and then only in strict proportion to the amount of benefit which he derives. Said one witness:

> "Suppose a machine is invented for which a manufacturer cannot afford to pay an adequate price outright, but the inventor lets him use it, and agrees that he shall pay the inventor so *many cents* per hundred articles manufactured on it. That is no burden to the manufacturer, and the inventor in the long run has his return, and if the machine is successful, he participates with the manufacturer in the success of it; but if it were going to be sold outright, the manufacturer would discount all chances and require it to be sold at a very small price."

Under this plan, the customer obtains physical possession of the patented article, together with the right to use it under the conditions of the license, but is not obliged to pay the patent owner anything for the right of use, unless he actually exercises it; and if he uses the patented article at all, he compensates the patent owner strictly in exact proportion to the efficiency of the patented article, and to the benefit that he derives.

Engineering

[illegible].—The Public Utilities Commission of the State of Connecticut, as a result of its investigation of the Westport crossover accident, has made an order that express trains on the New Haven Railroad shall come to a full stop before passing over crossovers which are "not safe for high speed." It was announced in the daily press that the president of the New Haven road has ordered that its No. 10 crossovers on express tracks be replaced, whenever it is possible, by No. 20 crossovers.

For Safer Ships.—The Senate Investigation here and the Lord Mersey Court in England did their work well, and their recommendations, if followed and embodied in legislative acts, will render the recurrence of such a disaster as happened to the "Titanic" impossible. Much depends upon the work of the International Congress, which is soon to meet in London. When its recommendations have been made public, they should be embodied in the laws of all maritime nations, before the lapse of time has weakened the stimulus of the disaster.

Ship-building Activity in Great Britain.—The British and Irish ship-building yards are enjoying an unwonted run of prosperity. At present there are 592 vessels, aggregating 2,366,371 tons, under construction, which represents an increase of 25 per cent over the tonnage of vessels being built last year. The shipyards cannot obtain sufficient men, and they are frequently working over-time and using double shifts. In spite of this activity, new orders are being taken faster than the ships are being completed. Though American operations are on a much smaller scale, it is gratifying to know that our yards are also full of work.

Panama Canal Rates Fixed.—President Taft has fixed the rates for the Panama Canal as follows: Merchant vessels carrying passengers or cargo, $1.20 per net vessel ton. Vessels in ballast without passengers or cargo, 40 per cent less than the rate of toll for vessels with passengers or cargo. For naval vessels other than transports, colliers, hospital ships and supply ships the rate will be 50 cents per displacement ton. American coastwise shipping is exempted from payment of tolls. It should be noted that the rates named in the President's proclamation are practically the same as those which will be enforced at the Suez Canal next year.

British 13.5-inch Gun Bursts.—The recent bursting of a British naval 13.5-inch gun at Shoeburyness will at once bring to mind the controversy which formerly raged over the question of the relative strength of wire-wound as against hooped guns, for we presume that the 13.5-inch piece was one of the new naval weapons which are carried by the latest British dreadnoughts of the "Orion" class. The advocates of wire-wound construction claim, or did claim before the recent improvements in hooped guns, that the wire-wound gun, because of the absolute inspection to which every part of it could be subjected, was proof against the kind of accident which recently happened at the proving ground.

Compression for Sound Ingots.—Benjamin Talbot, of Middlesborough, England, is securing good results with his system of fluid compression for producing sound ingots. During pouring, two ounces of aluminium per ton is added to the fluid steel. The ingot is soaked to give a thicker envelope and secure the desired temperature for compression, which is obtained by reducing it in the blooming mill, a 20 by 24-inch ingot being reduced to 18 by 18 inches. After further treatment in the soaking pit, it is rolled into a bloom which is ready for the mills. Rails rolled from these blooms are characterized by a hard working face, with a harder section behind it, and a somewhat softer center.

World's Longest Arch Bridge Being Built.—Work on the foundations of what, when completed, will be by far the greatest arch bridge in existence, is being actively prosecuted at Hell Gate, in the East River. The bridge, which has been designed by Gustav Lindenthal, will contain a four-track, steel, arch span of one thousand feet. It will be capable of carrying, with a wide margin of safety, four of the heaviest of our modern freight trains abreast at the same time. Including its approaches, the structure will be some three miles in length. It will serve to connect the New Haven and Pennsylvania systems by way of Long Island, the Pennsylvania East River tunnel and the Pennsylvania freight ferry across the upper bay.

Railroads and the Steel Trade.—Recent published statistics show what a vast amount of steel is demanded by the railroad system of the country for track and rolling stock. Thus, a single system, the New York Central, has sent out inquiries for between ten thousand and fifteen thousand steel freight cars. The United States Steel Corporation is asking for 3,000 cars, the Harriman lines for 5,000, and the total inquiry is for about 30,000 cars. There is a corresponding demand for steel rails, the Pennsylvania Railroad alone calling for nearly 200,000 tons for delivery in 1913; and it is believed that the demand in the United States, coupled with expected large orders from abroad, will bring the orders for rails for 1913 up to the enormous total of three million tons.

Science

The Tsangpo-Brahmaputra Question was left unsettled by the recent British expedition against the Abors, although a certain amount of geographical work was done in that connection. Now it is announced that another attempt will be made this winter to penetrate the unexplored region of the Upper Dihong, i. e., the portion of the great river of Tibet and Assam that is still a dotted line on our maps. The leader of the party will be Major Guntor, R.E., who will be accompanied by a detachment of military police.

The Bryant Expedition to Labrador.—Mr. H. C. Bryant, president of the Geographical Society of Philadelphia, recently spent three months in an exploration of the St. Augustine River, which enters the Gulf of St. Lawrence in Canadian Labrador. The river was ascended to its source, 141 miles, partly through country never before visited by white men. Only the desertion of the Indian guides, and an accident to one of the party, prevented Mr. Bryant from continuing his journey northward to Hamilton Inlet. Valuable entomological, geological, and photographic collections were secured.

The Livingstone Centenary.—The centenary of the birth of David Livingstone will be celebrated next March by the geographers of the world. The Royal Geographical Society, in London, will hold a special meeting on March 17th, when Sir Harry Johnston, the great African explorer and administrator, will deliver an address, and it is expected that Sir John Kirk, the only surviving companion of Livingstone on his expedition of 1858–64, will be present. The same society will hold an exhibition of Livingstone relics. Later in the month Livingstone will be commemorated in his native Scotland by a special meeting of the Royal Scottish Geographical Society, also to be addressed by Sir Harry Johnston.

An Agricultural Department in China.—The Republic of China has established a Department of Agriculture and Forestry on modern lines, and this institution has begun publishing an agricultural journal (all in Chinese), which appears three times a month. It is understood that a national meteorological service will be established as a branch of this department, and that it will be under the direction of Dr. Hing Kwai Fung, who was educated at Cornell University, and who for a year past has been attached to the Bureau of Plant Industry in Washington as an agricultural expert. Dr. Fung has started for China by way of Europe, where he will make a round of visits to meteorological observatories.

Dew Ponds.—Mr. Edward Martin, who has now spent some years in investigating the mysterious dew-ponds of the English downs (see SCIENTIFIC AMERICAN, August 6th, 1910, p. 100), made a progress report on this subject at the last meeting of the British Association. He stated that he "sees in fogs and mists the factor which tends to keep alive the best-made of the ponds. The precipitation of mist into the ponds, aided perhaps by silent discharges of electricity, and the entanglement of mist-laden salt-dust in the hollows in which the ponds lie, are believed to be the means by which some ponds maintain a supply of water all through the year, in spite of the great draught made upon them by numerous cattle."

A Signaling Anemometer.—The West and South Clare Light Railway, in western Ireland, has occasionally had its trains derailed by high winds from the Atlantic Ocean. In order to obtain timely notice of the occurrence of such winds the company has borrowed from the British Meteorological Office a pressure tube anemometer, which is installed at Quilty station in charge of the stationmaster. This anemometer is fitted with an electrical attachment, devised in the Meteorological Office, which gives a signal when the wind reaches a certain strength. The first signal is given for a wind velocity of 65 miles an hour; under such conditions ballast is placed on the trains to increase their stability. If the wind rises to 85 miles an hour a second signal is given, and traffic is then suspended.

The Variability of Solar Radiation appears to have a range of from 5 to 10 per cent, with an irregular period of from 5 to 10 days. That these fluctuations as measured within the earth's atmosphere represent actual changes in the solar output, and are not merely the result of local conditions of observation, can be determined only by simultaneous observations at two or more places on the earth. Some two years ago the Smithsonian Institution planned taking a series of observations of the solar radiation at some point in Mexico for comparison with simultaneous observations on Mt. Wilson, Cal. On account of the disturbed political conditions in Mexico this plan was abandoned in favor of a station in Algeria, where observations were made in 1911 by Mr. C. G. Abbot, director of the Smithsonian astrophysical observatory. As the weather was not very favorable, Mr. Abbot decided to carry out a second series of observations at the same place during the present year, and these have now been completed. Although the results have not been announced, it is believed that they will furnish more definite information than has ever before been available on the subject of solar variation.

Aeronautics

An Aerial Maxim at Aldershot.—Among the practical work being carried out by the Royal Flying Corps at Aldershot is an extensive series of experiments with a Maxim gun fitted to a biplane of the B.E. type. Canvas targets representing aeroplanes have been placed on *terra firma* and tests made by firing at them from heights up to 3,000 feet.

Operating a Parachute by Compressed Air.—In patent No. 1,043,836, William A. Hodge presents in connection with a parachute, and a compressed-air reservoir adapted to be secured to the aeronaut, a valve controlled nozzle for the reservoir which is arranged to discharge to the parachute, means being provided for releasing the parachute and for opening the nozzle valve so that the compressed air can open the parachute.

Burning of the Military Aviation Establishment at Sebastopol.—A disastrous fire occurred not long since which resulted in the destruction of a large amount of aeronautic material at the military aviation establishment at Sebastopol, Russia. The fire appears to have been caused by an explosion of gasoline, and this set fire to the machine shops in the first place, then the fire spread to the rest of the buildings on the grounds and three hangars were thus consumed, along with four aeroplanes, three automobiles and the storehouse for machine pieces. The loss is estimated at about $100,000

From Paris to Rouen and Return.—Hydro-aeroplanes will ply upon the Seine from Paris to Rouen and back, according to the events which are now being organized in aeronautic circles in the city, and prizes to the amount of $4,000 are to be offered on this occasion. It was expected to hold the contest about the middle of October, but it will be postponed for a greater or less time on account of administrative difficulties as to interference with navigation and the like which it will take some time to settle. The event is to be an international one and is likely to bring out some brilliant performances, as Deperdussin, Borel, Rep and Nieuport hydro-aeroplanes are already engaged.

Experiments in Automatic Control by Gyroscopic Means.—Some interesting experiments have been made in automatically stabilizing an aeroplane in both the transverse and fore and aft direction by means of gyroscopes. Numerous test flights with a Curtiss biplane were made over water in a hilly country under exceedingly puffy wind conditions. The automatic control device, which is regulated by means of a small gyroscope, it is said, held the machine on an even keel under the most adverse conditions. This device, which is the invention of a well-known electrical engineer, is intended to produce the proper degree of banking at all times when the aeroplane describes a curve, and if its speed falls below 36 miles an hour, it is designed to cause the machine automatically to volplane. Two small gyroscopes, one for the transverse and one for the longitudinal stability, are employed, and the extremely small amount of power to run them is obtained from a dynamo which can also be used to send wireless messages. The whole apparatus, including the dynamo, does not weigh more than about thirty pounds. We expect to publish a complete description of this device in the near future.

Results Obtained by the Bulgarian Aeroplane Corps in the War with Turkey.—Word has just been received from a well-known war correspondent giving the results obtained by the Bulgarian and professional aviators who took part in the war which is now about at an end. Thirty aeroplanes of different types were used, and both the officer aviators and the professional airmen made many flights accompanied by military observers. These flights were never made at a lower altitude than 1,000 feet and usually at between 1,200 and 1,500, which this correspondent claims is out of reach of rifle fire. We learn from another source, however, that an aeroplane was hit by bullets when at a height of 4,000 feet, but the bullets did not in any case do serious damage. We have already reported the death of the Russian Poppoff, which it is now claimed was due to the machine having caught fire in the air. The aviator and his companion were killed by the fall sustained as the result of this accident. It is extremely doubtful whether Turkish bombs set the aeroplane on fire as originally claimed. A Bulgarian aviator was also killed and another captured. The city of Adrianople was set on fire by bombs dropped from Bulgarian aeroplanes, but the latter were unable to hit batteries or small bodies of troops without flying too low for safety. As for reconnoitering, the results were not as sensational as in some of the European maneuvers, though nevertheless very important. A trained military observer found it easy, after a number of flights, to locate battery positions, infantry trenches, or any considerable number of soldiers when in the open country, but not when they were under cover of trees or in the streets of a town. When the information was not obtained on a first flight, a repetition of this flight generally brought it. No aeroplanes were used by the army which fought its way to Tchataldja.

An Automatic Gasoline Engine Cream Separator

By Frank C. Perkins

THE accompanying illustration shows a novel gasoline motor-driven automatic cream separator which is a most efficient farm labor saving device This machine is a combination gasoline engine and cream separator built into one the power being supplied by a four cycle ½ horse-power gasoline engine which in 15 seconds has the bowl running at full speed

No cranking of the engine is necessary as a short piece of rope is attached to the starting pulley and pulled over as in spinning a top

This separator has a capacity of over 700 pounds per hour and will skim faster than ten men can milk, and when the milking is done the skimming is done The engine is also equipped with a flat pulley to be used in operating a washing machine churn or any other hand power machine to which a gasoline engine is applicable The belt can be disconnected from the separator bowl in an instant and the result is an independent gasoline engine of ½ horse power

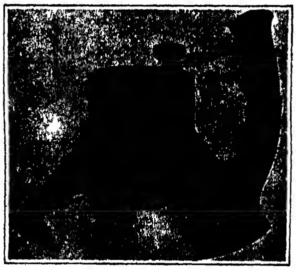
Automatic gasoline engine cream separator.

An Apparatus for Making Observations From Aeroplanes

By the Paris Correspondent of the Scientific American

A FRENCH engineer M Duchene has invented an apparatus for making observations from aeroplanes which is likely to prove very useful especially for military work The following description of the apparatus was presented at a recent meeting of the Academie des Sciences at Paris When engaged in scouting or other work it may at certain times be necessary for the observer to examine the ground over which he is flying and compare it with a map and this may have to be done for a considerable time during the flight Again he may need to identify the ground after having lost sight of it owing to a fog or at other times to note the exact position of a point on the ground a camp or body of troops for instance with reference to some prominent landmark But the main difficulty which aviators find in observations of this kind lies in the speed of the flight, and as this is likely to become much higher as time goes on the drawbacks will also increase Theoretically the aeroplane should stop on its flight so as to be able to obtain a perfect observation. One way to secure this is by making the aeroplane take circular flights around the ground to be observed but this also presents the difficulty that the ground appears to the eye to turn about in the opposite sense to the flight This effect is known to pilots to be very bad and aeronauts who mount in spherical balloons see the difficulty that is found in observing the ground and comparing it with a map when the basket is making even a slight rotation M Duchene's apparatus is designed to keep the image of the ground in a fixed position with reference to the observer's eye by using a set of two mirrors which are rotated oppositely to the aeroplane flight In this way the ground always shows the same aspect to the eye and the observer can compare it with a map without any trouble from the motion as before The apparatus consists essentially of a pair of plane mirrors *A* and *B* contained within a conical protecting cover *F* provided with a handle *G* The whole is properly fixed to the aeroplane so that the image of the ground is received in the mirror *B* This mirror is always inclined at a fixed angle of 45 degrees and is held on an arm so that it can rotate about the central part and follow around in the inside of the conical cover After once adjusting the mirror is solid with the arm and has no other movement than that of a rotation about the central axis so that it is always inclined at the 45 degree angle Mounted at the center is a smaller and vertical mirror *A* which can rotate about the central pivot but always keeps the vertical position It is evident that the image of the ground when received by the mirror *B* will be thence reflected horizontally into the mirror *A* and this reflects it horizontally into the observer's eye Should an object (or the ground) underneath *B* be made to change in position such object will no longer be reflected from *A* into the observer's eye but he would need to change his position so as to continue to see the same object What is now done is to keep the eye fixed as is necessary in an aeroplane and to rotate the mirror set by hand so that the pilot keeps the same image always in his line of sight while the ground is moving with reference to the aeroplane This is readily carried out by connecting the two mirrors by gearing in a way so that when *B* is made to rotate around its path *A* also rotates at just the proper angle to keep the image always in the same line that is in the observer's eye The movement of *A* thus continually compensates for the movement of *B* Stated more accurately if the mirror *B* is constantly operated by the hand so as to keep a fixed position in space (or with reference to the ground) while the aeroplane is in movement the image reflected from *B* takes the corresponding rotation which is equal to that of the aeroplane. To compensate for this and to keep the image always in the same line, the mirror *A* must rotate at an angle equal to half the angle through which *B* turns in one sense and the aeroplane in the other This is the principle of the sextant

All that is needed is to use a 2 to 1 gear ratio for the mirrors so that they rotate at the proper relative speed to meet these conditions, the large mirror turning at twice the rate of the small one, and the image of the ground is always sent into the observer's eye. He must operate the milled nut at the top so as to keep up the rotation of the mirrors and retain the image in his eye so that it appears fixed. This is easily done after a little practice. As the mirror *B* comes into a certain position around its path, it reflects the image from the other surface of *A* instead of the front, so that *A* must be silvered on both sides. This "dead point," however, can be passed over rapidly by properly operating the milled head. The inventor considers that the present design need not be a definite one, but is likely to be improved. It is sufficient, however, to show the principle of the apparatus.



Duchene apparatus for making observations from aeroplanes.

A small mirror silvered both sides *B* large mirror *C* arm supporting large mirror *D* gearing which by action of winding mechanism turns large mirror twice as fast as the small one *E* turning mechanism *F* protecting cover *G* handle *H* counterweight for large mirror

A Mechanical Bill Counter for the United States Treasury

By C. H. Claudy

MONEY counting is an art. Any one can count a small sum of money slowly To count a large sum of money quickly requires not only muscular skill of a high order, but strict attention. It is wearisome, nerve-racking. The monotony of it makes the human counter liable to error

So a mechanical automatic money counter is a machine greatly needed, not only in the Treasury of the United States and its sub-treasuries, but in banks, counting houses and other establishments where large sums of money must be totaled constantly

Not until Mr John P Buckley invented his money counting machine, however did the Treasury officials believe that mechanism could take the place of the human brain. But the single machine of its kind in the world now counting laundered money in the basement of the Treasury at Washington, is the first of a larger order and it is expected if the twelve machines now being made for the Treasury prove the possibilities indicated by the present machine to equip the Treasury with large numbers of them, as well as the sub treasuries

Mr John P Buckley is a special employee of the Treasury Department whose work it is to devise make and install special labor saving devices Certain plans were submitted for a money counting machine Mr Buckley was invited to make it. He looked at the plans and said, All right—but I can make a better one

Make both and we will see was the order given him

So Mr Buckley built the machine from the plans, and then designed and built his own and when they were tried side by side the Treasury officials threw up their hands.

'Take the other thing away, they said. 'Your machine is what we have been looking for!'

It may seem to the inventively inclined that a bill counting machine is not particularly difficult to make Any rotary mechanism into which bills are fed could be attached to a mechanical counter and would count perfectly so long as bills are put into it. The trouble with all such mechanism is that a revolution of the machine would count a bill whether a bill were present or not What is needed is a mechanism which won't count without the presence of a green back" in the mechanism Attempts to make such mechanisms which depended on the slight weight of the bill have been made before but are too delicate for constant use

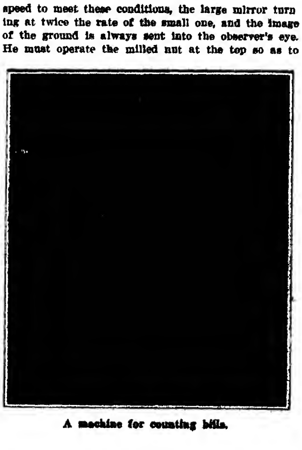
Mr Buckley's machine utilizes an entirely different principle which is absolutely certain in its action It cannot count without a bill in the machine

The attendant sits before a low table on which is a small and compact mechanism In front of her are several small rapidly revolving rolls of a metal on top of which are rapidly revolving wheels of brass. These wheels and rolls are in contact, and through them runs a small (half ampere) electric current. When a bill is fed in between the brass wheels and the rolls the circuit is broken The current has been actuating an electric magnet. The instant the magnet ceases to act, springs raise two flap doors to the compartment toward which the rolls and wheels are feeding the money The bill slips out of the rolls and rests on these little flap doors. The act of raising these doors by the springs has actuated a mechanical counter The instant the bill is ejected by the rolls, the electrical contact is re-made the magnets pull down the doors and the bill drops flat into the rack below

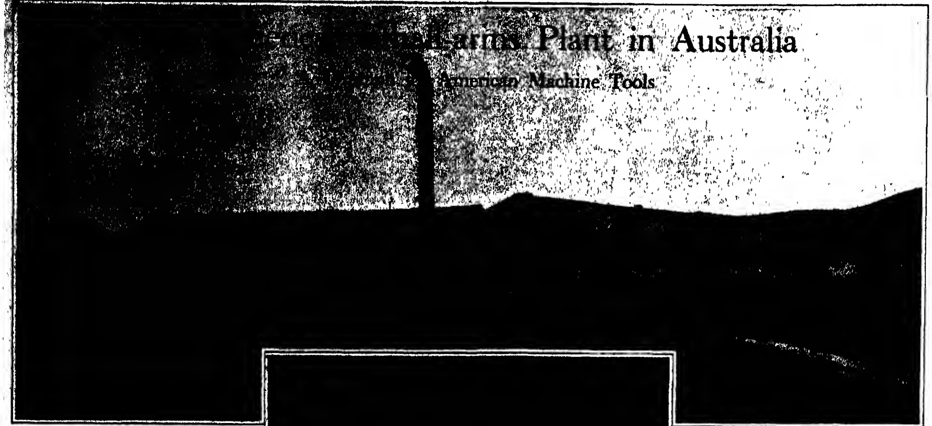
When ninety nine bills have fallen into the rack below, the little doors fly up as before for the hundredth bill, and count it, as before as it passes through the rolls. But the little doors do not drop down again, a mechanical trip holding them in place. This is the signal for the operator to put a piece of blotting paper or other separator on top of the hundredth bill. She then presses a button and the doors drop, carrying the hundredth bill and its separator into the magazine below

There are, in the present machine, three magazines, three sets of flap doors to them, three sets of rolls and three counters. There is also a general counter, which shows from one to one hundred on a dial, and

(Concluded on page 518.)



A machine for counting bills.



[illegible]-arms Plant in Australia

[illegible] American Machine Tools

A NOTABLE small arms manufacturing plant has recently been installed in Australia by the Government to manufacture military rifles. The contract was made under the auspices of the British Government, the rifle to be produced being identical with that with which the British army is now equipped, known as the Lee-Enfield.

This gun is one of the many adaptations of the original Lee gun—an American invention—the first one being made years ago in the works of the Pratt & Whitney Company at Hartford, Conn. The well-known Mauser is a Lee pattern, and the same principle is used in the guns of all the European armies. In the United States we call it the Springfield.

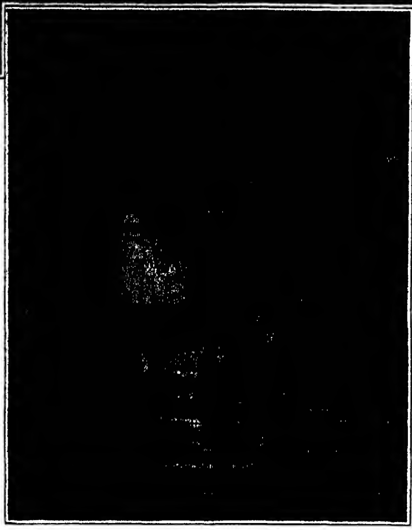
Bids were called for in London to furnish a plant to make Lee-Enfield guns at the rate of 50 per day. When Pratt & Whitney, the American company, applied for permission to bid, it was thought by the management of the Royal Arsenal that it would be impossible to make this plant outside of England, as it would be out of the question to have access to the British gages, and the Australian gun had to absolutely interchange in all its parts with the British weapon. The American experts, however, stated that if the British gun was made on the interchangeable plan, and their firm would be furnished with a gun, it would agree to produce one that would interchange with the other, creating its own gages from the gun itself.

The arsenal authorities were very skeptical as to this, and remained unconvinced until it was actually accomplished.

When the bids were received it was found that the American proffer was almost identical in amount with that of the most favored English firm. The latter, however, included in its tender some seven hundred machines to produce 50 guns in a working day of ten hours, as against less than three hundred included in the American bid. This, naturally, caused considerable discussion, as the American price was the same for less than half the number of machines, showing the price per machine to be much higher.

The two firms were then asked to state how many working hours would be required per gun. The Americans gave a guarantee that its plant would produce this particular gun at the rate of 23 hours per gun, while the English firm gave just double this time, and intimated that the American firm could not possibly make good its time; and called attention to the fact that in the Royal British Arsenal something like 72 hours was required per gun. A most interesting situation was thus created.

Finally the Australian gun expert, Commander Clarkson, was dispatched to America to investigate the subject, which he did in a most able and thorough manner, the result being that he reported the art of gun-making, as developed by the American bidder, to be many years in advance of anything that he had been able to find elsewhere; and recommended in the strongest terms that the award be given to the American firm, and this was at last done.



General lathe workroom for making small-arms.

Turret lathe workroom.

It was understood that the British gun was being billed to the colonies at cost, which was figured at something over $21, while the American guarantee as to working hours per gun meant a cost of about one third of this amount; in other words, on an order for 100,000 guns it means a difference in the cost of, say, $800,000 against $2,100,000.

The arsenal plant set up in Australia is now completed and fully in operation; is accepted under the guarantee and paid for.

The machinery was tested before shipment for the manufacture of 100 guns, and it was shown that the 23-hour guarantee could be materially lessened. Some of the sample guns made at Hartford were submitted to the British War Office, where they were thoroughly and critically tested, and a report rendered that was most satisfactory.

Thus an equipment of about 300 American machines was shown capable of producing double the amount of work that 700 British machines could produce, and there seems to be no other explanation of the facts.

We frequently hear of the superiority of American machine tools, but it is seldom that such a clean-cut case of comparison can be had; hence this transaction is highly interesting.

Australian Antarctic Expedition

THE ship of this expedition, the "Aurora," after landing two parties in Wilkes Land early in the year (1912) returned to Sydney. The following (southern) winter was spent in oceanographic research south of Australia. Efforts were made to locate the reported Royal Company Islands, and the fact was ascertained that they do not exist at the position shown on the charts, though, owing to bad weather, it was not possible to be sure that no land exists in the vicinity. In fact, severe storms beset the ship through the winter and seriously hampered her work. A visit was paid to Macquarie Island, midway between Australia and the Antarctic continent. The five men left here the previous summer by the expedition were found in good health and doing good scientific work. Their wireless station was working splendidly, with a radius of about 2,000 miles. Up to the time the "Aurora" left Macquarie this station had not been able to pick up any communication from the station which Dr. Mawson had planned to erect on Adelie Land, in Antarctica, but it is reported that communication has since been established. The ship returned to Lyttleton, New Zealand, July 11th. After refitting, she was to start south from Hobart, Tasmania, in the (southern) spring, for the south base of the expedition.

The Parcels Post Zone System

The New Maps and How They are Used

By Emma M. V. Triepel, B.S.

THE work of preparation for the establishment of the parcels post is now complete, and the system in the United States and between the United States and Alaska, the Philippines, the Hawaiian Islands and Porto Rico will go into operation January 1st, 1913.

The law authorizing this service, which was passed August 24th last, provided that for the purposes of the parcels post administration, this country and its several possessions, except the Philippine Islands, should be divided into quadrangular units of area measuring 30 minutes latitude by 30 minutes longitude, identical with a quarter of the area formed by the intersecting parallels and meridians, represented on appropriate postal maps or plans, and that each of such units of area should be the basis of eight postal zones.

The completed maps show the numbered quadrangles, with the eight zones which radiate off from the center of a given unit indicated by circles drawn at intervals corresponding to a radial distance of 50 miles for the first zone, which includes the given unit and all contiguous quadrangles, 150 miles for the second zone, 300 miles for the third, 600 miles for the fourth, 1,000 miles for the fifth, 1,400 miles for the sixth, and 1,800 miles for the seventh. The eighth zone includes all units of area outside the seventh. The numbers and boundaries of the quadrangles are printed black, while the zone circles and figures are red.

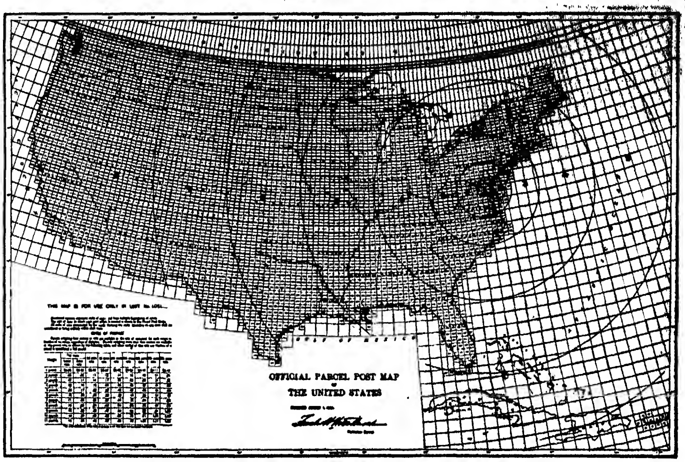
The law directs that quadrangles lying partly in two zones belong to the one nearer the common center; so that the zone lines on the map, if drawn in strict conformity with the actual working out of the system in practice, would not be true circles, but would present a serrated appearance, corresponding to the projecting outlines of the intersected units.

Each postmaster has been furnished a map showing the zones with relation to the quadrangle which includes his post office, and a Parcels Post Guide containing regulations and the names of all post offices, with their unit numbers. No scale or other device for measuring distances or calculating rates will be used, as the zone map and guide provide all requisite information. Copies of the map accompanying this article will be furnished to the Washington, D. C., post office and all others included in quadrangle 1,071. Later, copies of the maps with reference to any given unit and the Parcels Post Guides will be sold for about the cost of production, to the general public.

As an example of the method of procedure in mailing packages through this system, suppose a five-pound parcel is to be sent from Washington, D. C., to New York city. Consulting the Parcels Post Guide, we find that New York's unit of area or quadrangle is number 767. Referring to the map, that number is found in zone three. A glance at the table of rates, at the left lower corner of the map, shows that 27 cents will be the amount due.

Suppose a package weighing 4 pounds 3 ounces is to be sent to Benson, Arizona. Referring to the reproduced page of the Parcels Post Guide, we find that Benson is located in quadrangle 4,385. Consulting the map, unit 4,385 is found in zone eight, with relation to Washington. The three ounces must be considered as a whole pound. The table shows that the rate for 5 pounds to zone eight is 60 cents. Suppose a 9¼-pound parcel is to be forwarded from Washington to Chicago, whose unit of area is number 2,115. The map shows this quadrangle lying partly in zone four and partly in zone five, so that it must be considered as lying wholly in zone four. The ¼ pound must be considered as a whole pound. Consulting the table, it is found that the cost of sending 10 pounds to zone four is 62 cents.

As a local example, suppose the Washington post office receives a 5-pound parcel addressed to 1840 R Street. Consulting the table given with the map, the local rate for 5 pounds is found to be 9 cents. These



The official parcel post map which will be used by the city of Washington.

THIS MAP IS FOR USE ONLY IN UNIT No. 1071.

Numbered squares represent units of area, red lines indicate boundaries of zones.
The unit of area in which each post office is located is shown in the Parcel Post Guide.
All units of area intersected by the circle forming the outer boundary of any zone shall be considered as being entirely within such zone.

RATES OF POSTAGE

Parcels weighing four ounces or less are mailable at the rate of one cent for each ounce or fraction of an ounce, regardless of distance. Parcels weighing more than four ounces are mailable at the pound rate, as shown by the following table, and when mailed at this rate any fraction of a pound is considered a full pound.

Weight.	*1st zone.		2d zone rate.	3d zone rate.	4th zone rate.	5th zone rate.	6th zone rate.	7th zone rate.	8th zone rate.
	Local rate.	Zone rate.							
1 pound	$0.05	$0.05	$0.06	$0.07	$0.08	$0.09	$0.10	$0.11	$0.12
2 pounds	.06	.08	.10	.12	.14	.16	.19	.21	.24
3 pounds	.07	.11	.14	.17	.20	.23	.28	.31	.36
4 pounds	.08	.14	.18	.22	.26	.30	.37	.41	.48
5 pounds	.09	.17	.22	.27	.32	.37	.46	.51	.60
6 pounds	.10	.20	.26	.32	.38	.44	.55	.61	.72
7 pounds	.11	.23	.30	.37	.44	.51	.64	.71	.84
8 pounds	.12	.26	.34	.42	.50	.58	.73	.81	.96
9 pounds	.13	.29	.38	.47	.56	.65	.82	.91	1.08
10 pounds	.14	.32	.42	.52	.62	.72	.91	1.01	1.20
11 pounds	.15	.35	.46	.57	.68	.79	1.00	1.11	1.32

*For a full explanation of the rates of postage in the First Zone see the Parcel Post Guide.

Explanation of the map and the method of charging.

rates apply to rural delivery from the office where the route originates or from a patron on a route to the office where the route originates.

As an example of the application of suburban rates, suppose an 8-pound and 1-ounce package is to be sent from Washington to Annapolis, Md. The Guide shows Annapolis' unit of area to be number 1,021. The zone map shows that unit 1,021 is in zone one. The table indicates that the rate for 9 pounds in zone one is 29 cents.

Articles, to be mailable, must be not over 11 pounds in weight nor more than 72 inches in length and girth combined, nor likely to injure the mails or postal equipment or employees. There will be a flat postage rate of 1 cent per ounce up to 4 ounces, regardless of distance. Above 4 ounces, rates are by the pound and vary with the distance as shown by the table printed with the map.

The law provides that postage on all parcels shall be prepaid by affixing distinctive parcels post stamps. Hence, parcels bearing ordinary postage stamps will be treated as "Held for Postage." A dozen denominations of these special stamps, ranging in value from a cent to a dollar, have been prepared and are now being supplied to the postmasters. Parcels will be mailable only at post offices, branch post offices, lettered and local named stations, and such numbered stations as may be designated by the postmaster. Parcels will not be accepted for mailing unless they bear the return card of the sender. The problems of warehouse and terminal facilities, automobiles and other vehicles in which to convey parcel mail, street boxes suitable for the deposit of such mail and the utilization of present carrier force are among the questions involved which have been carefully considered by the Parcels Post Committee. One of its first acts was the issuance of bids for the purchase of 70,000 weighing scales for the post offices. Since many of the objects to be carried will be of a fragile nature, the question of indemnification for lost and damaged articles will be an important one.

The postal express business thus organized will not only cover all of the systems of transportation now utilized by private express companies, but will be extended to more than a million miles of rural delivery and star route service.

To Our Subscribers

WE are at the close of another year—the sixty-eighth of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

Electrical Ship Propulsion

MARINE engineering experience shows that the motive power for driving the propellers of seagoing vessels should be easily and quickly reversible, capable of being speeded up and down quickly, and able to run economically at almost any speed for long periods in smooth or rough water with less than eight per cent deviation. The machinery should all be easily accessible, economical in fuel, and have the simplest and fewest working parts. The fact that electrically driven vessels are the only ones complying with these requirements was pointed out in a recent paper read before an English engineering society. Attention was also called to the fact that with the electric drive the steam and power generating plants may be placed well forward, while the driving motors may be installed as far aft as the lines of the ship will allow.

Removal of the Beach Hydraulic Tunneling Shield

AFTER having been embedded in sand under Broadway at the south end of the tunnel opposite the south side of Murray Street, some eighteen or twenty feet below the surface of the street, for more than forty-three years, the Beach shield, regarded as the pioneer in its line, was cut apart and removed from its resting place on December 2d by the Degnon Contracting Company, the builders of section two of the new four-track subway under lower Broadway, between Walker Street and Mall Street. During this period the wood portion of the shield, which was located between the front and rear iron rings, had completely disappeared, but the iron parts were as complete as when originally installed. The eighteen hydraulic propelling rams were in good condition, the screw threads at their inlet ends, where the inlet pipe is attached, were perfectly fresh and good as if they had just been made. The iron inlet pipe was secured to the ram by a very heavy thick brass nut. The quarter inch thick iron hood, over two feet wide by about twenty-seven feet long, except for a small film of rust on its surface, was in serviceable condition. It overlapped the cast iron rear hydraulic ram ring and was secured to the woodwork just ahead of the ring with 4½ inch long iron bolts, having flat heads on the outside. The bolts were attached to the hood on its removal, a few having been reduced in diameter by rust.

The interesting feature is that this machine was made and operated by manual power day and night under Broadway with its heavy omnibus traffic going on overhead without in the least disturbing the same, removing only the actual amount of earth the tunnel was to occupy, and this before the age of steel and electricity as we know it to-day.

When the tunnel was being bored and the shield was near the north side of Murray Street a heavy stone wall was encountered; by careful management the stones were removed in front of the shield, leaving an arch in the wall near its top. When the opening through the wall was large enough the shield was pushed through it into the sand beyond. No one seemed to know why the wall was there; it was conjectured that it might have been the remains of an old Dutch fort. Since the excavation for the subway, some forty feet below the street surface, the supposed fort turns out to have been a large cistern of some kind and is probably one of many that used to be located in the center of the streets to supply water before water pipes were introduced. The parts of the Beach shield have been sent to Ithaca, New York, and presented to the College of Civil Engineering of Cornell University, of which Mr. E. E. Haskell is Dean, by Mr. Frederick C. Beach, son of the inventor, Mr. Alfred E. Beach (now deceased), where it is to be set up and restored for permanent exhibition. Mr. Alfred E. Beach was granted a patent on this shield in 1869. Particulars relating to its construction may be found in the SCIENTIFIC AMERICAN of March 5th, 1870, and its use in tunneling under rivers on a large scale is described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 764, of August 26th, 1890.

The Problem of Providing a Radium Container

WHEN making use of radium, some suitable containing vessel is needed, but glass or aluminium, which are commonly used, stop off some of the rays in each case, so that such rays are not allowed to act. This M. Lieber proposes to remedy by using a surface layer of radium compound applied as a coating on a suitable backing. To prepare the coating he dissolves the radium salt, in the case of coating upon celluloid, in ether, acetone or the like. The celluloid takes the shape of disks or rods and these can be dipped into the solution or the latter can be spread in a thin layer on the surface. After evaporation, the radinm is distributed in a uniform layer in this way, and the solvent is chosen so that it adheres well to the surface. When it is desired to use the radium in direct contact with liquids such as blood or other liquids of the body, a collodion coating is given to the layer, and this allows the emanations and also the α-rays to pass, as is proved by experiments. The method allows of obtaining powerful effects with a small amount of radium, which could not have been secured before, and all the emanations of the radium are utilized. It should be noted that the treatment of lupus and cancer requires the β and γ rays which are produced exclusively by the emanations, and these latter are well obtained here in a continuous manner. Celluloid tubes coated on the inside can be used for treating mineral water by the rays so as to have these absorbed by the water. Such tubes can also be employed for inhaling air through them in treating lung diseases, as the air thus becomes charged with radium. By coating glass microscope slides, specimens can be put directly upon them so as to study the action of radium upon microbes.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Yards Per Second

To the Editor of the SCIENTIFIC AMERICAN:

In your September 28th, 1912, issue you have an interesting article entitled "Why Not Feet per Second?" As you state in this article, it is quite true that we use the term "miles per hour" even when calculating rates of speed for very short distances, and your suggestion that "feet per second" be generally used is a very good one.

In this connection, would it not be better to use the phrase "yards per second" rather than "feet per second," in view of the fact that "yards per second" is approximately one half "miles per hour," and likewise "miles per hour" is approximately two times "yards per second"? Do you not think the proportions one half and two times, above mentioned, preferable and more convenient in calculation than one and a half times and two thirds as mentioned in your article? READER.

Yokohama, Japan.

The Pilot Charts and the Weather Bureau

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial in the current issue of the SCIENTIFIC AMERICAN regarding the renewed effort on the part of the Weather Bureau to take over certain of the work of the U. S. Hydrographic Office is quite apt and to the point. Without detracting in the least from what good work the Weather Bureau really does, it is pertinent to remember that its duties are but a development of an effort designed primarily to help the farmers of this country—hence its identification with the Agricultural Department. Its expansion along with other lines for the general public ashore is a logical evolution which will cover a sufficient field if it halt there.

The Pilot Charts issued by the U. S. Hydrographic Office are the combined fruit of the professional experience of our naval men and the civilian seafarers of all nations, and this product of co-operation is the consequence of that fraternal feeling which is a part of the mutual respect born of hazards shared in common. The sailorman, therefore, feels strongly when the documents and guides for his safety upon the sea are menaced through the editorship of landsmen, who are out of touch with the sea and with whom the merchant skipper can feel no inspiration to co-operate. It is this very sentiment of fellowship and understanding which now brings to the U. S. Hydrographic Office so much material of interest and value. ROBERT G. SKERRETT.

New York city.

The Mississippi Problem

To the Editor of the SCIENTIFIC AMERICAN.

For a few weeks I have been a resident in the upper edge of the great coastal plain, and have been studying the river problem, so apparent in the great bend just below us, and none the less between us and the Gulf. The last hill overlooking the Mississippi River on the west is at Commerce, Mo. Not far below, across the lowlands, is the St. Francis River, which seems to lose itself in the sunken lands of Missouri and Arkansas. To cut a canal to this stream, which could easily be widened and straightened, would not be a great task. Just above the mouths of the White and Arkansas, and across the same to another stream flowing into Red River, the cutting would be surprisingly small. Already the surplus water of the Mississippi is finding a way up the Red to the opening of the Atchfalaya and saving a hundred miles to the sea.

An examination of the route I have indicated shows an easy way to solve the river problem. This has been suggested by others, but is receiving less consideration than it deserves. The fall of the water would be about 300 feet. Locks might be a necessity in low water. A fine ship canal cutting off at least 300 miles, as measured by the river, would be a boon when the Panama canal is in operation. The flood of the Mississippi could be drawn off sufficiently to prevent the disaster incident to the usual high waters along the lower reaches of the river. The river would raise its bed from deposits less rapidly, and the necessities of the repair boats would be reduced. The river is being navigated without the 14-foot channel, and this would not be interfered with in the least. It would give two water routes instead of one. The energies of the Government, so soon to cease on the Isthmus, can be employed to no better advantage than in solving our river problem. It is hoped the citizens of the central valley will not allow this movement to be forgotten.

Olive Branch, Ill. C. W. CAMPBELL.

The Bath Tub Decision

To the Editor of the SCIENTIFIC AMERICAN:

Your attention is directed to the second paragraph of the editorial entitled, "The Bath Tub Decision and the Patent Law," appearing in the SCIENTIFIC AMERICAN of November 30th, 1912, and especially to the statement therein that "*Had that price been determined by the owner of the patents*, as in the rotary mimeograph case, and had there been no combination of licensees, the decision of the Supreme Court would have been different."

The decision in the Bath Tub case rests on the fact that there was a combination of licensees in restraint of trade within the prohibition of the Sherman law. Clearly, if the combination to restrain trade in an unreasonable manner could not be shown, the grounds for prosecution under this law must disappear.

The fixing of prices is an element of the restraint exercised by this combination; but in the absence of this element another might well be the foundation of such restraint, and I have read the decision in vain to find any foundation for the inference expressed by the SCIENTIFIC AMERICAN, that the fact of determination of prices by the combination, rather than by the owner of the patents, had any other bearing on the decision than to indicate restraint of trade by the combination.

The question as to whether a patentee may lawfully impose restrictions as to the price of an unpatented article, in the manufacture of which a patented article is used, is not decided by the Bath Tub case. Indeed, the Court expressly declares in its opinion that the decision is made "without entering into the consideration of the distinction of rights, for which the Government contends, between a patented article and a patented tool used in the manufacture of an unpatented article."

Accordingly, it is thought that the statement noted is misleading in so far as it includes, as a *ground for the decision*, the question of whether prices are determined by the combination or by the owner of the patents.

Washington, D. C. E. H. MERCHANT.

[It is true that in its decision the Supreme Court used this language: "The added element of the patent in the case at bar cannot confer immunity; and this we say without entering into the consideration of the distinction of rights for which the Government contends between a patented article and a patented tool used in the manufacture of an unpatented article." Our editorial was certainly not intended to convey the impression which our correspondent states was conveyed. The Bath Tub case clearly fell within the Sherman law. Our only point is that had there been no combination of licensees, had the owner of the patent granted licenses and fixed the prices without collusion, the decision would probably have been different.—EDITOR.]

The Prone Position for Aviators

To the Editor of the SCIENTIFIC AMERICAN:

Time and again it has been pointed out in the columns of this and other journals, that a stricter observance of streamline forms and sections in the design of an aeroplane would result in a marked increase in the craft's efficiency. In view of this, it might seem rather surprising at first sight that, though the principle has been very faithfully followed in the best machines as regards the design of wing profiles and certain other elements, so far no serious attempt has been made to construct a machine in which the aviator, engine, fuel tanks, etc., are totally inclosed in one streamline body.

The reason for this, however, is not an ignorance on the part of constructors of the advantages to be gained from such a form, but rather an acquaintance with the difficulties that underlie the construction of a machine such as would render the inclosing of the aviator practical. For they realize that the increase in cross-section required to inclose one aviator in a sitting posture, would necessitate a greater loading to obtain the highest efficiency; and with the addition of weight, fresh difficulties arise. Provision for variable surfacing would be absolutely essential in a large machine (for efficiency), and this latter has not been worked out as yet. Also, a more substantial running gear would necessarily need to be provided, and this again would involve an increase of head resistance.

But there is one way out of the difficulty which the writer has never seen proposed. Man's upright position is little calculated to cleave the air with least resistance. The position of the body which would offer the minimum of head resistance in flight is the prostrate one and the writer suggests that the aviator lie along the car with his body curved sufficiently for comfort. It would be a simple matter to work out the details.

Now this idea may seem somewhat fanciful; but flights in such a machine would undoubtedly do more toward impressing upon constructors the remarkable efficiency of the form, than any amount of theorizing or even of laboratory experimenting. It may seem more dangerous than the sitting posture; but the impetus given to the design and construction of a practical weight-carrying machine would justify the danger, such as the performance of dips, and dives, and other equally foolhardy evolutions in midair (infinitely more dangerous) never has nor will. G. L.

Whitby, Ontario, Canada.

Catapulting a Hydro-aeroplane from a Fighting Ship

Adapting the Flying Machine to the Requirements of the Navy

By Robert G. Skerrett

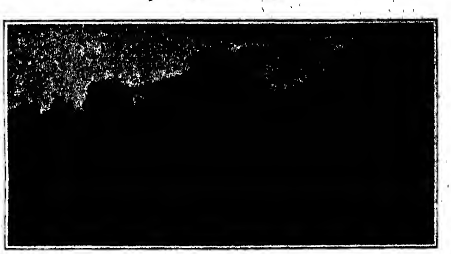
By the testing of an apparatus for the launching of aeroplanes from a ship, Capt. Washington I. Chambers, U.S.N., its inventor, clearly proved that the hydro-aeroplane may take its part as an essential feature of the equipment of all large men-of-war. It is doubtful if the general public realizes the prophetic significance of that performance at the Washington Navy Yard on the 12th of November. It marked a stage in the adaptation of the aeroplane for service with the fleet which began but two years ago, and was practical evidence of the surmounting of difficulties which were most discouraging in the early stages of the work. Appreciation of what Capt. Chambers has accomplished can be had by reference to the history of previous efforts described in these columns, of the scout cruiser "Birmingham" at Norfolk, where upon her forecastle deck was built a temporary wooden platform.

The next attempt was from the "Pennsylvania," and both served to prove that the aeroplane could not be a part of the fighting fleet if runways of so extensive and interfering a character had to be erected upon a vessel's deck.

The next development was Mr. Glenn H. Curtiss's hydro-aeroplane, and he continued to improve it till the boat could return to its base by alighting upon the sheltered water on the lee side of the ship and then be picked up and landed aboard successfully, but it had to be started on its scouting from the deck of the man-of-war.

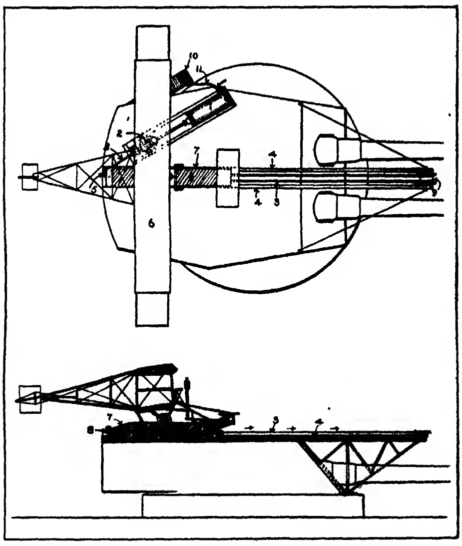
Capt. Chambers has long been one of our torpedo experts, and his early experience in launching those weapons from above water gave him a helpful hint, and his catapult tried at Annapolis some months ago was his first essay in projecting an aeroplane into the air upon a short track, and giving it in that distance the necessary headway required by the high-speed flying machine. Compressed air was the motive power and the launching device was mounted rigidly upon the wharf. The aeroplane was set upon a car which traveled upon a track about 35 feet long, and both were free to lift from the rails during any part of the travel or after the aeroplane motor had started and had reached a sustaining speed. The full air pressure, of 200 pounds, was turned into the cylinder which operated the cable attached to the car. There was no gradual acceleration of the translation of the supporting vehicle—it started forward with a jump! Upon the occasion of its trial, with the aviator in his seat, the aeroplane lifted at about midstroke of the piston. A cross wind was blowing at the time, the right wing was forcibly lifted, and the flying machine tumbled with a corkscrew motion into the water; also the pilot, Lieut. Ellyson. The test in question was twofold in its purpose—to project the aeroplane into the air after a short run and to observe the effects upon the aviator and the various parts of the apparatus. It was feared that the shock might derange the motor and other parts of the mechanism and incapacitate the aeroplane so that it could not take up the work of its own propulsion. Quite naturally, Capt. Chambers and his associates were gratified to find out that no part of the machinery or the fittings was ruptured or weakened by that venturesome performance. The fact that the aeroplane and the aviator were given a ducking was of secondary importance.

Profiting by the lessons learned at the Annapolis trial, Capt. Chambers devised the catapult tested so successfully at Washington, and what this means in the way of advance can be gathered by comparing it with the platform that was necessary when Ely made his flights from the U. S. S. "Birmingham" and the U. S. S. "Pennsylvania." The present launching apparatus is so small that it occupies but little space; it can even be mounted for use on top of a turret; it can be quickly moved to any position on the ship; and it can be readily dismounted and stowed away clear of the sweep of the guns. As in the case of the Annapolis device, compressed air is the source of motive energy, and this is always available on ships carrying torpedoes or using compressed air for other purposes. The necessary air, at a suitable pressure, is stowed in a small cylinder on deck conveniently located for connection with the catapult. The piston of the cylinder has a stroke of something like 40 inches, and the piston-rod movement is multiplied by means of a wire-rope purchase, and this wire rope draws forward the small wooden car upon which the aeroplane rests. In order to launch the flying machine, both it and the car are projected from the rails at the end of the run, and this takes only $1\frac{1}{2}$ seconds of time. The car simply drops out of the way, and if the rails reach to the side of a ship, the vehicle is recovered by means of a rope attached to it. The car gathers headway smoothly; there is none of the shock which characterized the operation of the pioneer apparatus at Annapolis, and this is accomplished by a clever arrangement which controls the increment of the air pressure automatically, and thus gradually accelerates the forward motion throughout the entire stroke of the piston. At Washington, the catapult was placed upon a float and the bottom of the hydro-aeroplane was not more than 2 feet above the water. This did not provide much of a margin for the machine to dip ere its motor took up the work of propulsion. However, when the test was made, the flying machine arose gradually and steadily upon a beautiful flight as soon as it left the rails, and there was not the slightest tendency to seek the water. It is true that the float was pointed toward the wind, but at the time of the trial the



The hydro-aeroplane at the instant of leaving the catapult, with Lieut. Theodore H. Ellyson at the wheel.

The launching car of the catapult is seen below the pontoon in the act of falling away toward the water.



Plans and side views of Capt. Chambers's catapult for launching aeroplanes from battleship turrets.

1. Catapult motor operated by compressed air from tank 10. (11 air connection.) 2. Pulleys that multiply the movement of the tractor cable. 3. Tractor cable connecting the catapult motor with car 8. 4. Rails on which car 8 runs. 5. Pulley for cable. 6. Flying machine. 7. Float of hydro-aeroplane. 8. Car. 9. Pulley.

A preliminary test of the catapult.

The car was loaded with heavy sandbags to represent the weight of the flying machine, and the box like block uppermost in the air was held to the car by the same holding-down strap that serves to secure the hydro-aeroplane until the moment of its desired release. The relatively light car is seen falling away from the heavy sandbags and the block which played the part of the flying machine.

The catapult just before the machine was launched.

Before the flying machine is launched the catapult is placed upon a float and the bottom of the hydro-aeroplane is not more than two feet above the water. This does not provide much margin for the machine to dip ere its motor takes up the work of propulsion. The machine rises gradually and steadily upon its flight without any tendency to seek the water.

[illegible] nearly calm. Just the same, the [illegible]ing was of such a character that [illegible] experts express confidence in the fit[illegible] of the catapult for service aboard [illegible]. Certainly much credit is due Lieut. [illegible]son for the nerve and courage he has shown in eagerly offering himself for these tests, and this fact gives additional value to the claims now made for the catapult. It is of interest to note that [illegible] the demonstration at Washington—contrary to that at Annapolis—the aeroplane was held down to the car by an iron strap, and this was released by a tripping device which engaged an arm of the strap at the far end of the rails. This made certain the aeroplane thus acquiring sufficient velocity to give it a lifting impulse at the end of the launching run.

Because of recent improvements in the hydro-aeroplane and the development of this catapult, Capt. Chambers confidently predicts the following uses of the flying machine in naval warfare, and these give us an impressive idea of the way the art has advanced in the last two years:

They can be carried, stowed, and used by all large ships for the purposes of:

1. Reconnoitering an enemy's port or to search out his advanced bases and to assist in the operations of a blockaded or of a blockading force.

2. To locate and destroy submarine mines, submarines, and dirigibles, and to assist in the operations of submarines and torpedo boats.

3. To damage an enemy's docks, magazines, ships in repair or under construction, dirigible sheds, and other resources.

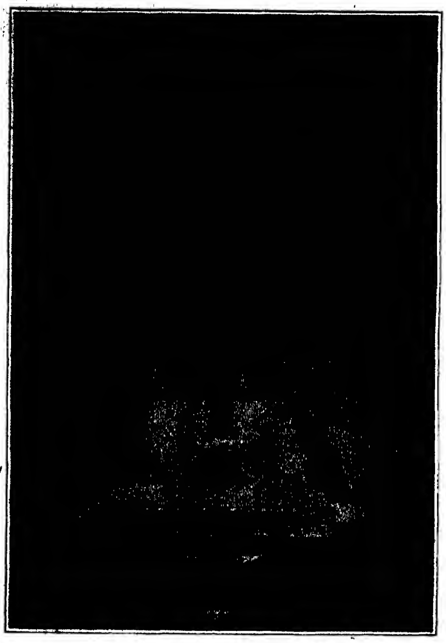
4. To provide means of rapid confidential communication between a fleet commander and the commanding officer of a co-operating force on shore, or the commander of another fleet or division.

They can be carried by all scouts and cruisers.

5. To extend the "eyes of the fleet" in naval scouting.

They can be carried, with ample supplies and camp outfit, on board any naval supply auxiliary.

6. For scouting at advanced bases and for extensive use with expeditionary forces.



Capt. Chambers's catapult for aeroplanes.

A Notable Great Lake Passenger Steamer

THE American river steamboat is a peculiarly American type, standing in the same relation to steamships in general as does the multi-masted American schooner to the sailing ship. Its strongly marked characteristics are due to the influence of local conditions of navigation and to certain national demands in the way of comfort and general accommodations. Whether it be found on the Mississippi or the Hudson, or in the sheltered waters of Long Island Sound, there are certain leading characteristics which make the type readily recognizable, and differentiate the American craft from any other of its kind in the world.

To our thinking it is the most picturesque and impressive of all the stately vessels which carry the world's commerce; and although the largest of them are but half as long as such ocean liners as the "Olympic" and "Imperator," the effect of their imposing and many-storied tiers of staterooms, and the long, clean lines of hull and superstructure, is to deceive the eye into thinking them greater than they are—an effect which is heightened by the fact that they are generally seen against a background of small river craft or against the moving panorama of river bank or proximate shoreline.

To those of us who are familiar with the majestic boats that ply on the Hudson and Long Island Sound, it will be surprising to learn that the growth in size of the sidewheel passenger steamer on the Great Lakes has been so rapid that to-day the largest vessel of this type is to be found on those waters. We present illustrations of this steamer, the "City of Detroit III," which has been built for the service between Detroit and Buffalo. The principal dimensions are: Length over all, 470 feet; keel, 455 feet; breadth, 55 feet 4 inches molded; breadth over guards, 96 feet 6 inches; depth at stem, 22 feet; depth at stern, 20.25 feet. The hull is built of steel with double bottom. It is divided into eleven compartments by water-tight, cross bulkheads, extending from the keel to the main deck. The bottom is divided at the center line and athwart-ships into fifteen water-tight tanks. There are two decks below the main deck and three above. The main deck and housing on the main deck and orlop deck are also of steel. A steel superstructure is carried to the main deck. The ceiling of the saloon deck is sheathed with galvanized iron, practically making the entire housing up to the saloon deck fireproof. A steadying tank of 100 tons capacity is provided amidships to check rolling in heavy sea.

High and low-pressure cylinders for the "City of Detroit III."
Diameter high-pressure, 62 inches; low-pressure, 92 inches; stroke, 102 inches; horse power, 8,000

The ship is driven by paddle-wheels; and she is the longest paddle-wheel steamer afloat. The engine is of the inclined, three-cylinder, compound, jet-condensing type, having one high-pressure and two low-pressure cylinders. The estimated indicated horse-power is 8,000 at 30 revolutions per minute. The high-pressure cylinder, which is 62 inches in diameter, weighs 47,200 pounds. It is placed between the two 92-inch diameter low-pressure cylinders, all having a compound piston stroke of 102 inches. The high-pressure cylinder is fitted with poppet valves and Seckles cut-off gear; the low-pressure cylinders have Corliss valve and gear. All the valves are operated by ordinary double-bar Stevenson link motion,

(Concluded on page 51[illegible].)

"City of Detroit III," largest side-wheel steamer afloat.
Length, 470 feet; breadth, 55 feet 4 inches; breadth over guards, 96 feet 6 inches; horse-power, 8,000; speed 21 miles an hour.

Working a Whistler

A Dangerous Task That Requires Skill

By C. H. Claudy

SEA-TRAVELERS up and down our coast lines often hear a strange, weird sound to port or starboard, a sort of compound of moan and shriek, at once soft and insistent, subdued and penetrating. It is the call of the whistling buoy to the man at the helm, warning him of shoal or dangerous place, giving him his bearings, by which he may steer his vessel in safe water.

These whistling buoys, which are enormous masses of iron, often weighing several tons, are as simple in principle as they are certain in operation. The buoy proper consists of a huge pear-shaped bulb, little end up, on top of which is a powerful whistle, protected from accidental blow or collision by a framework of iron bars, and an air intake. Below and projecting far down into the water is an open tube of metal. The whole thing is secured in position with an anchor and a chain, which last is long enough for the depth of the water in which the buoy is placed, to permit the free movement of the mass up and down.

When a wave lifts the buoy up in the air, the water in the tube, acting as a piston, sucks in air through the intake. It is confined in the bulb of the buoy by a simple valve which prevents its egress through the intake. When the waves drop the buoy in the trough of the waves, the water in the tube presses up on the confined air and compresses it. It finds exit through the whistle, which thus sounds its warning note.

Whistling buoys are only placed in water where the wave action is fairly constant, so that calms and fair weather will not stop the action of the buoy any more than can be helped. It should be noted, however, that the buoy is less needed in fair weather than in foul, and that it takes comparatively little disturbance of the water to make the buoy sound its warning. The higher the waves, of course the louder the sound.

There are eighty-eight of these buoys at present in service in this country, and twenty-five whistling buoys which are also light buoys, showing a visible signal at night. They differ in size, from the small ones used in harbors and where the sound need not be very powerful in order to reach as far as may be necessary, to the huge masses of iron which are given to the water as a plaything at the entrance to harbors or wherever a shoal needs a warning signal which cannot, or for other reason should not, be cared for by a lighthouse.

It might be supposed that, having no mechanism but a valve, such buoys, once put in position, could be left there for an indefinite period of time. But the sea has strange ways with her playthings, and, even if the necessity of constant painting of the buoy to protect it from the action of sea water was not existent, it would still be necessary to keep a watch on these signals, and to take them up and replace them rather often. For the big tube projecting down into the water is a great attraction to barnacles and sea weed, and not infrequently these marine growths so interfere with the action of the buoy as to keep it silent in ordinary weather and to dim its voice in bad weather.

It then becomes necessary to "work" a new whistler in position, which is a regular part of the duty of a lighthouse tender or buoy tender, of which vessels there are many in the Lighthouse Service.

When a buoy is to be "worked," the tender repairs to a yard or station, and by means of her crane, lifts on deck the freshly painted and thoroughly repaired new buoy, which is to replace that one which is either silent or which has served its allotted time and is now due for replacement.

There is nothing difficult about this; it is getting the enormously large and unwieldy mass of iron overboard and taking on board the one which is in the water, which causes the difficulty. The very waves which are necessary to the successful operation of the buoy make it hard to manage at the end of a crane on board a comparatively small vessel.

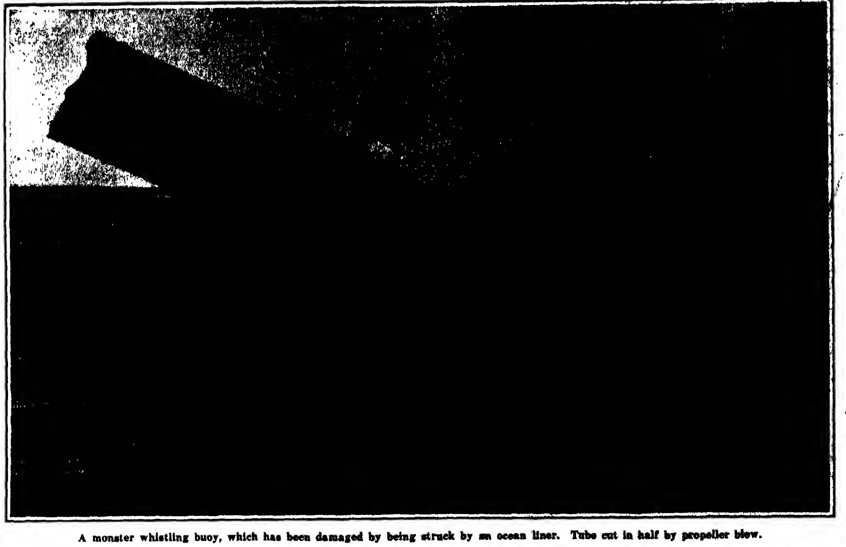
When a buoy tender goes to "work" a whistler she clears her deck of everything else but the buoy, which is secured with chocks and chains against the roll of the vessel. The old buoy is approached cautiously, within a couple of hundred feet, and the new buoy is allowed to slide overboard, rather than picked up and placed in the water, the crew guiding it by guy ropes while the powerful crane lifts just enough to permit the buoy to move. With the vessel slowly rolling from side to side on the slow seas of even a quiet day—the good days are purposely picked for this work—the mass of freshly painted iron with its long tube presents potentialities for evil which must be closely watched. Let the buoy but get clear of the deck and the fall tackle get jammed, and there would come into being a three-ton pendulum with an iron flail, thirty-six feet long, capable of smashing the boat to bits and certainly of sweeping broken-boned men about the deck with no more effort than if they were so many flies.

When the new buoy is safely into the water and its anchor and chain tossed after it, the unusual spectacle is presented of two whistling buoys side by side. But the new buoy is silent.

"Lazy—doesn't want to work," say the sailors. But it is only waiting until the water has filled its long tube to take up the burden of its mournful song—a sound so indescribably melancholy that the department has always scores of protests from land dwellers when one of these sirens is placed within sounding position.

But if getting the new buoy overboard is dangerous work, hauling the old one in is more so. The buoy is first secured by good seamanship, managing the steam vessel, with a rope through the iron cage at its top. Working from this, ropes, chains and "springs" or heavy cables are brought into play and the whole very cautiously lifted and secured as it comes over the side. It is allowed to swing free not at all, save perhaps for an instant, just as it is laid flat on the deck, and then, apparently in the very face of death, a dozen men spring at the mass, ready to swing with the waves and to demolish them, and thrust huge billets of wood underneath its sides, to hold it long enough for lashings to make it secure. The boat, being belayed to the anchor chain, then cautiously backs away to raise the anchor, perhaps buried for months in the mud, and there is a general scampering away from the cable while this is being done, as should it break it would be like having a couple of cannon balls come tearing along the deck; a breaking two-inch cable is as rigid as an iron bar and with hundreds of tons of force in its swift flick through space.

However, so skillful are these handlers of heavy masses of iron on an unstable keel, that it is rare that an accident happens, while most of those which occur to whistling buoys are caused either by their being run down and their tubes cut off by the propellers of large vessels or by their being damaged by ice.



A monster whistling buoy, which has been damaged by being struck by an ocean liner. Tube cut in half by propeller blow.

Rope Shoes for Horses

IN Germany many horses are being shod with shoes made of tarred rope. The object is to prevent slipping on streets covered with asphalt or paved blocks. In some of these shoes there is also a block of wood, into which stiff bristles have been driven. This is an additional preventive against slipping, and strengthens the shoe. They are light and comfortable for the horse, and deaden the sound of the hoof.

Readers are invited to contribute to this department photographs of novel or curious objects, unique occurrences, or ingenious contrivances. Such as are suitable will be paid for promptly.

Aeroplane Vans for the French Army

SOME time ago we called attention to the horse-drawn vans that were being used by the French army for the transportation of aeroplanes. The French War Department is now making use of automobiles for this purpose, and our illustration shows a number of motor vans with their trailers used for the transportation of an *escadrille* of aeroplanes. The aeroplanes are dismounted and placed in the trailers, and the motor van is used for the transportation of spare parts, etc. Each *escadrille*, consisting of from six to eight aeroplanes, has a couple of machine-shop repair trucks such as we illustrated a few weeks ago. These trucks have sides which open and form work benches, while they are fitted with all the necessary lathes and machine tools used for the repairing of aeroplanes. The new motor transport vans effect a great saving of time in the moving of aeroplanes from place to place when it is not desired to send them by the air route.

Motor vans and trailers for French army aeroplanes.

Austrian army ultra-violet sterilizer filling a water tank.

A Violin Made of Matches

THERE are certain individuals who have a penchant for putting to curious use, materials that others consider worthless. Thus a man will make a clock out of bits of straw or a cane out of old newspapers. Here is a picture of a violin, the body of which was built of matches. A man living in Bay City, Wisconsin, conceived the novel idea, and spent a year in the painstaking operation of constructing a musical instrument out of the refuse of the match-box. "The instrument contains 5,450 matches," says the man who sent us the photograph, and he also assures us that the violin has "a full, sweet, mellow tone," which, if really so, strikes us as even more remarkable than its peculiar construction. The instrument has been on exhibition at the Minnesota State Fair, where it attracted a great deal of attention.

A violin built of 5,450 matches.

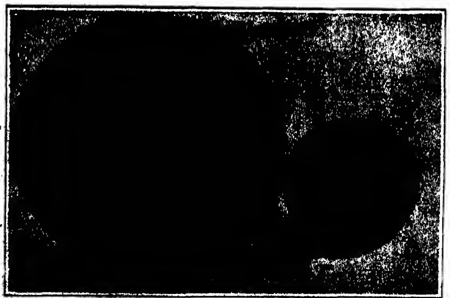
The Acme of Car Luxury

IN order to travel with all the conveniences of the twentieth century, and even to dine in privacy *en route* without being compelled to leave her car, a German singer of note has ordered a traveling limousine which must be considered the acme of luxury. As the illustration shows, it can be converted into a dining room, completely and luxuriously fitted. By a few deft touches it can be transformed into a "boudoir," card-room or bedroom. The seats are adjustable so as to form a broad and comfortable davenport bed.

A limousine converted into a dining car.

Girdling Orange Trees

PICTURED herewith is a Washington navel orange weighing 3¼ pounds and measuring 18 inches in circumference, which was grown by Mr. Robert Howe in Orlando, Florida, in 1892. Beside this giant specimen may be seen a kumquat and a nonpareil. Mr. Howe had a number of Washington navel trees, which bloomed more profusely than any other variety, but would not hold their fruit, producing an average of one box per tree. In the spring of 1893, just when the fruit began to appear he girdled the trees, taking out a strip of the bark about ¾ inch wide. The result was a yield of from eight to ten boxes per tree, while a large majority of the oranges were of an enormous size, but thin-skinned and full of juice. Some of the largest were displayed in the "Florida on Wheels" exhibit, a car loaded with Florida products that ran all over the Northern States. The trees were girdled again the next two years and gave a full crop, but the fruit was all of medium size. In February, 1895, all the trees were killed by frost. Grape vines, apple trees and the like are sometimes girdled to obtain larger fruit, but this is usually attended by a diminution of the quantity of the yield. Such was apparently the case with Mr Howe's orange trees; for as the size of the fruit diminished in successive years the quantity increased.



Giant orange produced by girdling, compared with a nonpareil and a kumquat.

Ultra-violet Light Sterilizer for the Austrian Army

THE new French ultra-violet ray water purifying apparatus has been made up in portable form and is now being tried out by the Austrian army upon its first trials. As the apparatus is intended to be used for a supply of pure drinking water for troops in the field, it is a complete plant, containing its own machines for operating pumps and producing electric current so that it can be set up at any point on the field When on the road, the small front truck containing the driver's seat and also a supply box is attached to the apparatus proper, which is mounted in the rear box upon a two-wheeled truck. When on the spot, the rear box is detached and opened up, and the sterilizing tank removed and set up on a tripod support so as to be within easy reach of the troops. Within the case is a well-designed plant consisting of a small gasoline engine coupled to a rotary pump and also to a dynamo. A hose leads from the pump to the source of water supply, such as a well or pond, and the water is pumped up and sent directly into the sterilizing tank if it is quite clear, or if not it passes first through a rapid filter. A short piece of hose connects the plant to the sterilizer, and electric wires also make connection with the dynamo so as to supply the mercury vapor lamp. A set of instruments serve to give the proper amount of electric current, and automatic devices cut off the current when the water is not flowing out of the tank, in which case automatic valves also stop the water supply from the pump The present apparatus is likely to be valuable in keeping up the good health of the troops, as when on the field the water is often taken from polluted sources, and this is recognized to be one of the main causes of disease. Researches made at the laboratories of the Paris University by Prof. V Henri show that provided it is so clear as not to prevent the ultra-violet rays from penetrating below the surface, water which is heavily charged with coli bacillus and other most dangerous microbes, is rendered quite harmless Such microbes are, in fact, entirely destroyed by the powerful action of the rays, as is shown by numerous analysis

Artificial Marble

THE artificial, or stucco, marble is in the main part composed of gypsum, which should be hard, so that the product can be smoothed and polished To the finely powdered and sieved burnt gypsum marble dust is often added and the mixture gaged with water in which mucilage has been dissolved. The colors and the streaks or veins, the able imitation of which is the main object in the manufacture of artificial marble, are added to the dry mixture, as mineral colors, or during the hardening of the finished product upon its surface by aid of chemical compositions.

To obtain streaked slabs large balls of gypsum are kneaded with smaller ones of different colors, and from the ball so obtained thin slabs are cut, which are laid upon the still damp base and then subjected to high pressure. After hardening the slabs are planed. To avoid this toilsome operation of planing, a sheet of glass, highly polished and rubbed with oil, is used. Colored lines representing the veins are traced upon this sheet; then a ⅜-inch layer of a thick mixture of gypsum of the desired color is carefully poured over the glass and left to harden After hardening the slab is carefully removed, and the surface next to the glass will be found to be absolutely smooth, and need no planing.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Wanted: A New Patent Office Building

MUCH has been written and printed recently with regard to certain needs of the patent system of the United States, and a bill for the complete revision of the patent laws has been before the Committee on Patents of the House, ever since April 12th, 1912. Whatever may be the arguments for and against this proposed revision of the patent laws and its consequent effect upon the industries of the United States, there can be but one side only to another important need of the United States Patent Office. This is the need for a new and modern building to accommodate the working force of the office and to provide adequate and fireproof storage for the priceless records of more than one million patents.

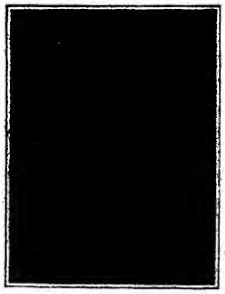
Uncle Sam has a good paying business in the United States Patent Office. He makes so much money there that after paying for every conceivable expense in the issuance of patents, including the salaries of the examiners and the clerks, he can count the handsome profit of more than seven millions of dollars on deposit in the United States Treasury. But what would you think of a business man who made a profit year after year, a gradually increasing profit, and who used it for his own benefit, or piled it up in the bank without putting some of it back into the business in the shape of improved facilities? It is evident that such a man could not go along very far without meeting a great slump in his business. Having something in the way of a monopoly in granting patents, however, Uncle Sam pockets the profits and lets the inventors and the Patent Office employees get along as best they may. It is true he did have a burst of generosity about four years ago and raised the pay of his examiners. That was done, however, because there was a constant procession of examiners through the office, and resignations to go elsewhere and get more pay came so fast that the Commissioner felt that he could scarcely recognise half of his employees by sight and much less call them by name.

The appointment of Commissioner Moore in 1907, however, started the ball to rolling for newer and better things. The salaries were raised and the examining corps placed upon the highest state of efficiency possible with the present salary rate. True, there are resignations now—law firms and corporations are always looking for trained men—but the difference between the Patent Office salaries and the inducements offered is not so great now and more men stay in Washington to perfect themselves in the knowledge of patents and patent law.

This feat accomplished, one would suppose that Mr. Moore was content to rest on his laurels. But not a bit of it. Scarcely had he executed this task safely than he began banging on the doors of Congress for money to improve the Patent Office building. Business was good, plenty of money was coming in, and the employees were satisfied, but Uncle Sam still clung to his old-fashioned, thoroughly obsolete building.

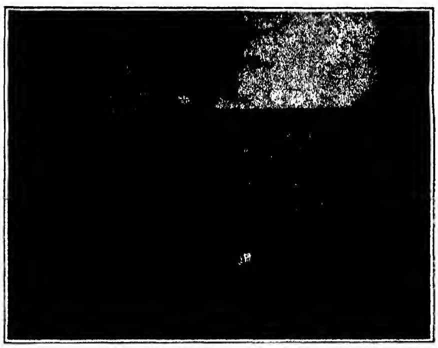
Issue and Gazette Division.

Where the completed patents are prepared for issuance. Note the crowded desks and walls occupied by open shelves on which are valuable documents



A cell-like storage room.

No sunlight or outside air ever reaches this place; yet copy-pullers must work here getting out copies of patents by the aid of artificial illumination.



Patent Office Court.

A breathing space which must be sacrificed for a much needed addition because Congress will not permit the use of the Patent Office surplus to erect a modern building.

A corridor view.

A copy-puller on the left. Copies of patents stored between two outer doors, where street dust reaches them constantly.

The paste room of the Patent Office.

Here copies of patents are assembled. This is a room into which sunshine never penetrates.

A corner where dust accumulates.

Showing temporary shelving where patents are exposed to dust from the street in a basement corridor.

THE SCIENTIFIC AMERICAN has repeatedly called the attention of its readers to the urgency of this need. It has published extracts from the Commissioner's reports in which he has sturdily fought for the permission of Congress to either enlarge the present structure or to erect an entirely new and up-to-date building and business equipment.

Now the idea is not, as might be supposed, to spend money on a showy and palace building for the benefit of sightseers in the Capital City. No such use of the public's money is contemplated. The need for a new Patent Office building is a real one, not purely a craze for showing off. It might be said, by those who are accustomed to see working people huddled together in lofts and dark holes and corners toiling for their daily bread, that the present Patent Office is far better than the quarters in which some people have to work. And it is possible, too, that the employees could get along, working ten or twelve in a room, or in rooms where the cubic-foot supply of fresh air is far below the standard set by the laws of health. There are plenty of precedents for such conditions. But what about the records of the office? If common humanity toward employees is not a moving reason, there is a still more serious one at hand. If it were not for the gravity of the situation, it would be laughable to note some of the expedients adopted in the cramped quarters allotted to the Patent Office, quarters in which human beings must work, desk by desk, cheek by jowl, occupied in important technical work, nerve-racking and brain-teasing, and in which precious papers and documents are piled from floor to ceiling, gathering dust and dirt. It is as if a house had no closets and all the family's effects were strewn about willy-nilly.

This is a condition which should and does concern the people at large. They are directly and personally interested in the records of the Patent Office. The destruction of valuable assignments of patents, whereby the titles to inventions are held, might mean the loss of millions of dollars to the commercial world, and deal a staggering blow to the nation's business integrity.

Every week an average of nearly a thousand patents is granted. Every week space must be found for the records in these cases. They must be kept conveniently, too, because they constitute works of reference, and are consulted daily. Then, too, space must be found for the printed copies of the patents. More than a million United States patents have been granted, and copies of these are sold every day of the week. These copies must be so conveniently disposed that when an order for a single copy or a hundred copies is received by the office, the "copy puller" can go directly to the place of storage and extract the copies. A large force of boys is actively engaged in this work, and considering the makeshifts which are resorted to to find storage space, their work is anything but pleasant. The corridors of the Patent Office are banked high with copies of patents on wooden shelves, where they are exposed not only to dust and dirt, but to fire also. This danger of destruction by the last is an ever-present one. A cigar or match or cigarette carelessly tossed away might start a conflagration that would be difficult to check before it accomplished great destruction.

Aside from untiring vigilance, the one way to prevent this is by the construction of a fireproof modern building for the Patent Office. The proposal to do this has been repeatedly urged upon Congress by the Commissioner of Patents in his reports and before the committees. Bills have been introduced which had as their aim this important measure, but a champion of this measure in the halls of Congress has yet to be discovered. This puts the matter squarely up to the Congress, and is a poignant example of the penny-wise, pound-foolish policy of the present day. Economy is one thing, and neglect is another. So far as the Patent Office is concerned, the attitude of Congress has been extremely negligent. The members overlook the fact that the Patent Office is a self-supporting bureau. Little question would arise as to the propriety of building a new post office in a town where the business had long since outgrown its existing quarters. Why, then, is the building of a new Patent Office looked upon with such indifference? All Congress has to do is to authorize an expenditure out of the present surplus in the Treasury which has been earned by the Patent Office—a sum of money which has been paid in by the inventors of the country, and which represents the net earnings of the bureau.

The proposition is one of business, purely and simply. It is not good business to display your wares in ugly surroundings; it is very poor business indeed to hang on to your profits, when their judicious investment would be sure to bring in more and better business. The lack of money has resulted in poor internal facilities in the Patent Office; and these same facilities have resulted in an output that is not as perfect as it should be. Of course, enormous improvements in system have been accomplished in the past few years, but perfection can hardly be hoped for among the present surroundings and the restricted facilities now existing.

"Give us more room" is the continual cry of the heads of the examining divisions, and the Commissioner is helpless to relieve the situation. He has partitioned off the last available inch of corridor, crowded in the last possible desk or filing case, and cleaned up the last adaptable cellar or vault to make it fit for workers and documents. He has succeeded in getting into the sundry civil appropriation bill this year an item which contemplates building an addition to the present structure, a make-shift which is far better than none, but pitifully inadequate when the great needs of the office are considered. This addition, if the appropriation is allowed, will occupy the greater part of the interior court of the present building. This court is a small park, a breathing place for the employees, and its loss will not add to the light and ventilation of those rooms which face on the court. It was necessary, however, to make this sacrifice in view of the refusal of Congress to consider a measure for an entirely new building. But this is merely staving off the inevitable. Sooner or later a new and modern building must be provided. At the lowest estimate it will take five years to build such a structure.

At the hearings before the Senate Committee on Appropriations upon the item proposing to spend $220,000 for a building to be located in the interior court of the Patent Office, Commissioner Moore stated some very plain facts as to the insanitary conditions of the building, and also the grave danger which threatened the records. In this he was backed up by Dr. Warren of the Public Health and Marine Hospital Service, who stated that the cubic feet of air space for each employee was only one third of what it should be, with no possibility, under existing conditions, of remedying this condition. Senator Gallinger asked him whether he thought the Patent Office was a "tuberculosis factory," and Dr. Warren replied in the affirmative, and deplored the fact that little boys of sixteen years of age were forced to work in these dusty and ill-ventilated holes and corners, where stacks of files cut off both light and air.

Senator Warren, the chairman of the committee, was of the opinion that the records of the Patent Office were about as safe as a haystack would be in a forest fire, and added: "It just reminds me of an old-fashioned farm barn, when they stuff the scaffolds and the bays, as we call them, and then the forage or produce gets into the stable room, and there it is, all over every place."

It must not be supposed that the Patent Office is not kept clean. Vacuum cleaners are used and everything is carefully gone over frequently, but when things are exposed constantly, dust and dirt rapidly accumulate and the most careful "house-keeping" cannot keep up with the abnormal conditions.

You who live far from the capital of the nation know little of the difficulties which beset those who are placed in administrative positions. Public buildings in great numbers there may be, but each one represents a struggle with Congress that has caused more than one official to give up in despair. High rents are paid for inadequate working quarters year after year, when a lump appropriation at the start would furnish space a-plenty and comfort for all time.

It is easy to set down facts, but hard to drive them home to those whose interest is courted. Every man who reads these lines ought to feel his personal interest in the matter of the Patent Office. Even if you are not an inventor, you may become one at any moment. Even if you never do, nor never intend to, you are a consumer, and as such profit by the inventions of others. If the patent system of this country were not so excellent and so wisely founded, many of your daily necessities would be yet unborn. For aught that is known, Edison, Maxim, Marconi, Morse or Westinghouse might never have had that incentive which is furnished by the protective patent laws of the nation.

What are a few hundred thousand dollars, or even a couple of million dollars compared to the commercial supremacy and perpetuity which depend upon the United States Patent Office?

Let the reader try to understand the simple statement, made as clear as possible, viz.: The Patent Office has earned the money; it has the money; only Congress can give the authority to spend part of it for a new building to take the place of the old structure it now occupies; Congress refuses. Result: Employees are unable to work under the best conditions, necessarily affecting the output of the office, and invaluable records are in danger of gradual destruction from exposure, or sudden destruction by fire.

Ignorance may be as largely responsible as indifference for the conditions which exist, but to be fore-warned is to be forearmed, and it cannot be charged against the present administration of the United States Patent Office that it has failed to persistently call attention to existing conditions.

The American Patent System

RESOLUTIONS ADOPTED BY THE BOARD OF DIRECTORS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

THE numerous bills now pending before the Congress and greatly modifying the patent system in the United States, have received the attention of the American Institute of Electrical Engineers. Recognizing that the patent system has been, and is, a tremendous factor in building up the present industrial prosperity of this country, thereby greatly contributing to the prosperity of the country as a whole, and that any untoward change in the patent situation might disastrously affect this condition of industrial and general prosperity, and the conditions contributing to their continual augmentation, the Institute has passed resolutions, the more important of which are the following:

"*Whereas*, in view of the intimate relation of the Patent System to the general welfare, no action looking toward any radical change in the Patent System should be taken without most careful consideration, and

"*Whereas*, in our opinion, proper consideration of such important changes as are proposed can be had only by an unbiased, non-partisan commission, made up of men from various walks of life and not from any one vocation, or interest.

"*Be It Resolved*, that the American Institute of Electrical Engineers, acting through its officers and board of directors, respectfully urge the Congress of the United States that they provide for a commission, made up of unbiased, independent, non-partisan men of such national standing as will command the respect of the whole country; and chosen from different walks of life; and not more than one from any one calling or interest; and serving without pay. Such commission to hold public hearings, and otherwise, as may appear to them best, to make a thorough and careful study of the American patent situation, and to prepare and submit a comprehensive report and recommendations to Congress for such changes, if any, as may, as the result of their study, appear to them expedient, whether in the Patent Office, in the method of court procedure, or in the organic patent law, and recommendations as to the legislation they would propose for effecting said changes. And that we further respectfully urge that the Congress make ample provision for the expenses of said commission, and

"*Be It Resolved*, that we respectfully urge the Congress of the United States to hold in abeyance all proposed legislation affecting the Patent System in whatsoever way until such time as the said commission shall have had ample opportunity to hold the said hearings, and make the said study and report, and

"*Be It Further Resolved*, that these resolutions be printed and a copy be sent to each Senator and Representative of the United States who is a member of the Senate or House Committee on Patents."

Notes for Inventors

Five United Shoe Machinery Company Patents.—The United Shoe Machinery Company, as assignee of Frederick M. Furber of Haverhill, Mass., has just secured four patents, Nos. 1,043,083 to 1,043,086, inclusive, for cementing machines and a patent, No. 1,043,087, for device for applying liquid to shoes or other stock.

Improved Tire Fabric.—Harry K. Raymond of Akron, Ohio, assignor to the B. F. Goodrich Company, has secured a patent, No. 1,043,143, for a tire fabric which includes a strip of woven rubber-treated fabric composed of a plurality of sections arranged bias with the transversely extending edges of each of the sections provided with a series of tongues overlapping and secured to the adjacent section.

The Real Inventor of the Telescopic Spectacles.—In the SCIENTIFIC AMERICAN of November 23rd, 1912, we published an article by Dr. L. K. Hirshberg on "The Telescopic Spectacles." The author gave credit for devising the telescopic spectacles to Dr. K. L. Stoll, whereas Dr. Stoll was simply the first to demonstrate them in this country. Since this places Dr. Stoll in an embarrassing position, we call attention to the fact that the discovery is to be attributed to Prof. E. Hertel, formerly of Jena, but now of Strassburg, Germany.

A Hand-operated Knot Tier.—In patent No. 1,041,039, John T. Dalton and John Clayton Dancker of Baltimore, Md., present a hand-operated knot-tying implement which includes a pair of pivotally-connected levers with a knotter and a gripper carried by one of the levers and means carried by the other lever for operating the knotter and a cam carried by said other lever for operating the gripper.

Chemical Vessel to Withstand High Temperatures.—Byron E. Eldred of Bronxville, New York, who has assigned to the Commercial Research Company of New York city, has secured patent No. 1,043,579 for a chemical vessel or crucible in which there is a core layer of ferrous metal which is completely enveloped and hermetically sealed in by a surface layer of a noble metal with the surface layer welded to the ferrous metal.

Two Peter Cooper Hewitt Patents.—The Cooper Hewitt Electric Company of New York, as assignee of Peter Cooper Hewitt, has secured patents No. 1,043,104 and 1,043,766. The former includes the combination with a plurality of oscillatory circuits of the same periodicity and means for charging said circuits independently and means so that the circuits are discharged according to a predetermined time relation with the discharge periodicity of each of the circuits, a multiple of the periodicity of the charging voltage. In the patent No. 1,043,766 is described the method of generating high frequency currents of impulses which consists in charging a plurality of oscillatory circuits and discharging said circuits successively.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

HOLDER FOR COWS' TAILS.—W. M. UNDERHILL, Oconto, Wis. Numerous objections are overcome by the use of this improvement. The holder being loosely suspended from overhead, the cow is free to move her tail, and by reason of the fact that the tail cannot be switched from side to side below a certain plane, all inconvenience and annoyance to the milker is obviated.

Of General Interest.

MARCEL WAVER.—J. W. BUICKEROOD, 26 2nd St., Boundbrook, N. J. This improvement pertains to toilet articles and especially to devices used in dressing the hair, the special object being to provide a waver of a cheap and simple nature and which may be used rapidly and with the highest degree of satisfaction and without injury to the hair.

DAVIT HOOK.—C. A. PEARN, 700 Lime St., St. Johns, Newfoundland. This improvement relates to a ship davit hook for use in lowering and hoisting life and other boats. It provides a hook particularly adapted for use at the end of a boat raising tackle, constructed to automatically disengage itself from the boat ring as the boat strikes the water.

FORESIGHT FOR SMALL ARMS.—R. DE BARTOUCH, 37 Scarsdale Villas, Kensington, London, England. The invention relates to foresights for fire-arms of all kinds and the object is to obviate the difficulty which the user of a rifle, pistol or like weapon often experiences in distinguishing the foresight, especially when firing rapidly or under unfavorable conditions as regards sighting.

APPARATUS FOR REGISTERING THE CONSUMPTION OF LIQUID FUEL.—R. F. O. CHAUVIN and R. ARNOUX, 186 Rue Championnet, Paris, France. The object of this invention is to provide a controlling apparatus for registering the quantity of liquid fuel consumed by thermal motors, as for example the quantity of petrol (gasoline) consumed by an explosion engine, and under conditions which will render fraud impossible.

COIL PROTECTOR.—H. E. BAILEY, 64 Lodge St., Albany, N. Y. This invention relates to refrigerators used for cooling beer and other liquids immediately previous to dispensing the same at a bar or the like. It provides a protector arranged to protect the coil in the refrigerator cabinet or casing against injury when packing ice into the opening of the coil and around the coil within the cabinet.

NURSING BOTTLE SUPPORT.—W. H. SAUNDERS, 507 W. 46th St., Manhattan, N. Y., N. Y. This invention particularly relates to a means for supporting the bottle on the side of a child's crib or carriage, and an object is to dispose the bottle within reach of the child and a further object is to provide a support which may be readily removed from the crib or carriage.

Machines and Mechanical Devices.

CAP FEEDING MECHANISM.—A. JOHNSON, 14 Dunham Place, Brooklyn, N. Y. This mechanism is especially adapted for use on bottle capping machines, and the principal object of the invention is to provide a construction whereby the caps will be fed to the cap-affixing mechanism in proper sequence and in correct position.

MACHINE FOR BENDING LUG STRAPS.—G. F. IVEY, Hickory, N. C. This invention provides for bending wooden lug straps for picker sticks of weaving looms; and provides a method of bending wooden straps to form lug straps to avoid splitting or marring the surface of the strips.

HEMMING ATTACHMENT FOR SEWING MACHINES.—W. NICHOLSON, care of Blosser, Heynemann & Co., 77 Battery St., San Francisco, Cal. The purpose of the invention is to provide a hemming attachment for sewing machines, arranged to permit of accurately passing the material through the scrool to insure the proper formation of the hem, even if the material is provided with cross seams or other thickened portions.

VALVE.—J. J. MEYER, 366 Lenox Ave., New York, N. Y. This valve or ball cock is arranged to insure an easy opening and closing of the valve, to present a different portion of the surface of the valve disk for contact with the valve seat at each operation, and to insure long life to the valve, also to prolong the period of repairing or rewashering thereof and to prevent waste of water by leakage.

Designs.

DESIGN FOR AN AUTOMOBILE LAMP.—A. E. MOODY, 254 W. 22d St., Manhattan, N. Y., N. Y. In this ornamental design for an automobile lamp, the upper and light reflecting part is of round construction, and is seated on a base from which tapers the connection portion.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

Inquiry No. 9288. Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289. Wanted substance melting at 325° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor.

Inquiry No. 9290. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292. Wanted a gum that will stick labels to grape-fruit.

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth.

Inquiry No. 9294. Wanted to buy glass balls 1¼ x 1¼" in diameter.

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

A Mechanical Bill Counter

(Concluded from page 508.)

to which is attached a bell which rings whenever a count is made. Should the current go through the paper for any reason—as sometimes happens in counting money fresh from the laundry which is still damp—the doors do not fly up and the bell refuses to ring, and the attendant is thus warned that the bill is not counted. She then slips it through a second time, or she can lay it aside until dry, substituting a dry bill. It is because of this dampness of the bills that the money counting machine is installed in the laundry room, in order to give it the most severe test possible.

But the greatest feature of this machine is not yet told. If in a pile of money there are, for instance, one dollar bills, five dollar bills and twenty dollar bills, it is impossible to count them by "ruffling" the bills and "walking" the fingers through the pile, dividing them into mentally counted sets of four or five—the way piles of bills of one denomination are counted by hand. Such a mixed pile must be separated into its component kinds, a separate count then being made for each kind, involving one count for each kind, as well as a separating count.

But with the Buckley counting machine, all this extra work is obviated. The girl tending the machine simply feeds all the "ones" in the one box, the "fives" in the five box, and the "twenties" in the twenty box, and the machine counts each boxful separately and prevents her from putting more than a hundred bills in a pile without a separator between the hundreds. Should there be ones, twos, fives, tens and twenties in a pile, a machine with five counters and five magazines will do in one operation what the human counter must do in six operations!

The machine absolutely relieves the operator of mental strain. She does not count the bills, merely feeds them into the machine. An expert is able to do this at an average speed of 5,000 bills an hour, or 35,000 bills a day. A speed of 15,000 bills a day by mental counting is considered highly expert work. To go faster means liability to errors and great weariness on the part of the operator.

With mixed piles of bills, the machine will count in hundreds of thousands of dollars where the human counting machine will count in thousands, simply because it can do at one operation what the human counter must do in several.

Mr. Buckley is now at work on a money counting machine which will be automatically fed, so that one attendant can count bills to the amount of a hundred thousand a day, and perhaps more. This will be on the lines of the present machine with a pneumatic pick up and feeding mechanism on somewhat the same idea as an automatic press feeding machine is constructed. This machine has not yet been completely worked out.

A Great Lake Passenger Steamer

(Concluded from page 513.)

and the cut-off in each cylinder has a range of from one fourth to three fourths of the stroke, adjustable from the starting platform. None of the cylinders are steam jacketed, but together with the two large tank receivers they are well insulated. The crank-shaft is 25 inches in diameter in the engine bearings, 27½ inches in diameter at the outer bearings, and 71½ feet long, from end to end. It weighs 108½ tons. The connecting rods are 20 feet center to center and 13½ inches in diameter at the center of their length, and each weighs 10 tons. The piston rods are 12 inches in diameter. The paddle-wheels are unusually strong and heavy and are designed to successfully meet the severe ice conditions met with in the early part of the season. The centers are of cast steel and the arms of forged iron, with the large gudgeon bosses forged on and bushed with lignum-vitæ. The wheels are 30 feet 3 inches in outside diameter, each fitted with 11 curved steel buckets 14 feet 6 inches long by 5 [illegible]

ported by a 14-ton steel truss. Steam at 160 pounds per square inch pressure is supplied by six cylindrical return tube boilers. The boilers are placed in two batteries of three each and are fired in a fore-and-aft direction, the coal being carried in three athwart-ship bunkers.

On the owners' trial trip the run from East Shoal to Long Point, a distance of 133¼ miles, was made in six hours and twenty minutes at an average speed of 21.04 miles per hour. On this run, one of the safety valves blew off at 140 pounds, so it is fair to assume that under a full head of steam the "City of Detroit III." can maintain an average speed of well over 21 miles per hour.

Wireless Telegraphy Without Sparks

IN wireless telegraphy, electric oscillations created in an arrangement of conductors, or antennæ, produce electric waves of the same period or frequency in the surrounding ether, through which the waves move with the velocity of light, 300,000 kilometers per second. This length of the wave is obtained by dividing this velocity by the frequency, so that a commercial alternating current of 50 cycles per second would generate aerial waves 6,000 kilometers in length. It would be necessary, however, to employ an antenna 600 kilometers long, as it has not been found possible to construct an antenna capable of emitting waves more than ten times longer than itself. An antenna having a length of 600 meters, which is about the practical limit, would emit waves 6,000 meters long, and would require an alternating current of 50,000 cycles per second.

In practice the high frequency required is obtained by the oscillatory discharge of a condenser through a spark-gap. Some inventors have devised alternators of frequencies ranging from 25,000 to 100,000 which can be connected directly with an ordinary antenna without intercalating a condenser and spark-gap, and other inventors have endeavored to construct, within an area of practicable dimensions, antennæ capable of emitting waves from 30 to 60 kilometers in length, when connected directly with alternators of 10,000 to 5,000 cycles per second, which can already be furnished by electrical constructors. The problem of the suppression of sparks has been treated variously in various countries.

The American inventors, Fessenden, Alexanderson and others, have beaten all records for high frequency alternators. Alexanderson has constructed machines of 200,000 cycles per second, a frequency corresponding to a wave-length of 1,500 meters, which is given many antennæ in actual use. This machine, however, makes 20,000 revolutions per minute and possesses mechanical peculiarities too audacious for practical use, from which its low efficiency (less than 5 per cent) is alone sufficient to exclude it.

The German school appears to have limited the area covered by the antenna to 20 hectares, and the length covered to 1 kilometer. Two solutions of the problem have been found. The Telefunken company has adopted Count Arco's alternator, which has a normal frequency of 50,000 to 60,000, and is capable of furnishing frequencies of 30,000 and 120,000. The power consumed is 25 kilowatts, and the power delivered is variously estimated at 2.5 and at 6 kilowatts. The construction of the machine remains a secret.

Rudolf Goldschmidt has constructed several machines in which the initial frequency of 12,000 is increased to 48,000 by the introduction of condensers and inductance coils, in accordance with a principle enunciated by M. Boucherot in 1898. The efficiency is superior to that of Arco's machine and may possibly be as great as 50 per cent.

In France the problem has been treated in a very different manner. Before attempting to construct alternators of very high frequency it is rational to inquire how high a frequency is desirable. It is possible that an antenna of practicable dimensions might be so constructed as to

emit very long waves and hence to permit the employment of an alternator of moderately high frequency, which would be more efficient, durable and practical than a machine of 50,000 cycles per second. As the product of the frequency by the wave-lengths is equal to the constant velocity of propagation, the diminution in frequency caused by the omission of the condenser and spark-gap can be compensated equally well by increasing the frequency of the alternator, the wave-length of the antenna, or both at once.

The last mentioned expedient has been adopted by M. Béthenod, who has recently devised a very successful system of wireless telegraphy without sparks.

The antenna in sheet form suggested by Blondel in 1903 already makes it possible to produce waves about ten times as long as one of its component wires. It has been learned, furthermore, that wave-lengths of 15 to 30 kilometers, or more, are most advantageous in respect to the reach of a wireless station.

In 1905 Slaby attempted to increase the wave-length of the antenna by introducing capacities and inductances, and made many experiments with antennæ of the sinuous type, but he was unable to arrange his coils and condensers so as to produce the desired result.

In 1908 H. E. Athearn of New York suggested the use of horizontal sheet antennæ of the Blondel type, but with Slaby's sinuous or zig-zag arrangement of wires. An antenna of this sort, however, emits waves of several different lengths, which produce a confusion fatal to practical utility.

Béthenod's method of introducing inductances and capacities gives a wave-length about ten times greater than that of an ordinary sheet antenna carried by the same supports. The wave-length is proportional to the square root of the product of the inductance by the capacity. The difficulty of increasing the inductance and capacity of a system carried by given supports is caused by the formation of nodes at the added inductance coils, so that the wave-length corresponds to a part of the antenna instead of the whole, and consequently is not increased, but is diminished.

Béthenod has discovered the law which permits the simultaneous introduction of inductances and capacities in such a manner that the wave-length is increased. Considerations affecting patents make it impossible at present to give drawings and calculations of the Béthenod antenna.

As a practical example, however, it may be stated that an antenna having a wave-length of 60 kilometers would be less than 1 kilometer long, and would require only 6 or 8 supporting pylons if it were of the Béthenod type, while it would be at least 10 kilometers long and would require 30 pylons if it were of the sheet form actually employed by the English Marconi Company and the German Telefunken and Goldschmidt companies. For a wave-length of 6 kilometers the corresponding numbers of pylons would be 4 and 10.

In view of the facility with which these long-wave antennæ can be constructed and the increased reach obtained by using long waves, it is evident that alternators of frequency greater than 10,000 are not required. A diphase alternator is preferable to a monophase machine. The only objection to the use of diphase alternators, the necessity of employing two antennæ, placed at right angles to each other, has been eliminated in the Béthenod system by a device which reverses one phase before the current enters the antenna.

The new system offers several advantages in addition to those of simplicity and economy. In ordinary wireless telegraphy the principal wave is attended by a train of waves of different lengths, which make accurate tuning impossible, but the sustained waves of the new system, absolutely uniform in length, permit rigorously precise tuning and close approximation of stations without danger of interference. By means of automatic transmitters and receivers a speed of 200 words

per minute can be obtained. This is ten times the speed of a simple Atlantic cable or six times that of a duplexed cable. Hence, wireless telegraphy without wires promises to become a formidable competitor of cable transmission. The new system also promises to make wireless telephony practically possible.

A Rule to Find the Day of the Week upon Which Any Given Date in the Christian Era Fell

By John P. Atchley

FOR all dates prior to and including September 2d, 1752 (which are calculated according to the Old Style calendar), divide the number of the years by four, rejecting the remainder if there is any; to this quotient (1), add the number of the year (2), add the number of days up to and including the given date (3), (always counting 28 days in February; and for any date in January or February of a leap year, take, in adding, one less than the total number of days to the given date). From this sum of (1), (2), and (3), subtract a correction of two and divide the resulting number by seven. The remainder left will indicate the number of the day of the week—0 representing Saturday, 1 Sunday, 2 Monday, etc. (Note that every year evenly divisible by four was a leap year under the Old Style.)

Date of Christ's Crucifixion, April 3d, 33.

```
4)33
   8  (1)
  33  (2)
  93  (3)
 ---
 134
   2  (correction)
 ---
7)132
  18 + 6, or Friday.
```

Follow the above rule for all dates after September 2d, 1752 (which are calculated according to the New Style calendar), except that instead of subtracting a correction of two before dividing by seven as above, subtract a correction obtained as follows: Take the figures denoting hundreds in the given year and divide them by four; the difference between the quotient thus obtained and the said figures is the desired correction. Thus for 1905:

```
4)19
   4      19 — 4 = 15,
```

which is the correction for 1905. (Note that under the New Style century years as 1300, 1800, 1900, etc., are not leap years unless evenly divisible by 400, and this correction is to allow for those century years that are omitted as leap years—three of them in each 400 years.

July 4th, 1905.

```
4)1905
   476  (1)
  1905  (2)
   185  (3)
  ----
  2566
    15  (correction)
  ----
7)2551
   364 + 3, or Tuesday.
```

The change from Old Style to New Style was made by English-speaking countries in September, 1752, when eleven days were dropped from the calendar and the 3d of that month passed as the 14th. Most dates previous to that time are given according to the Old Style, but some important ones have been changed to the New Style. For instance, Washington was really born on February 11th, 1732, according to the calendar in use at the time.

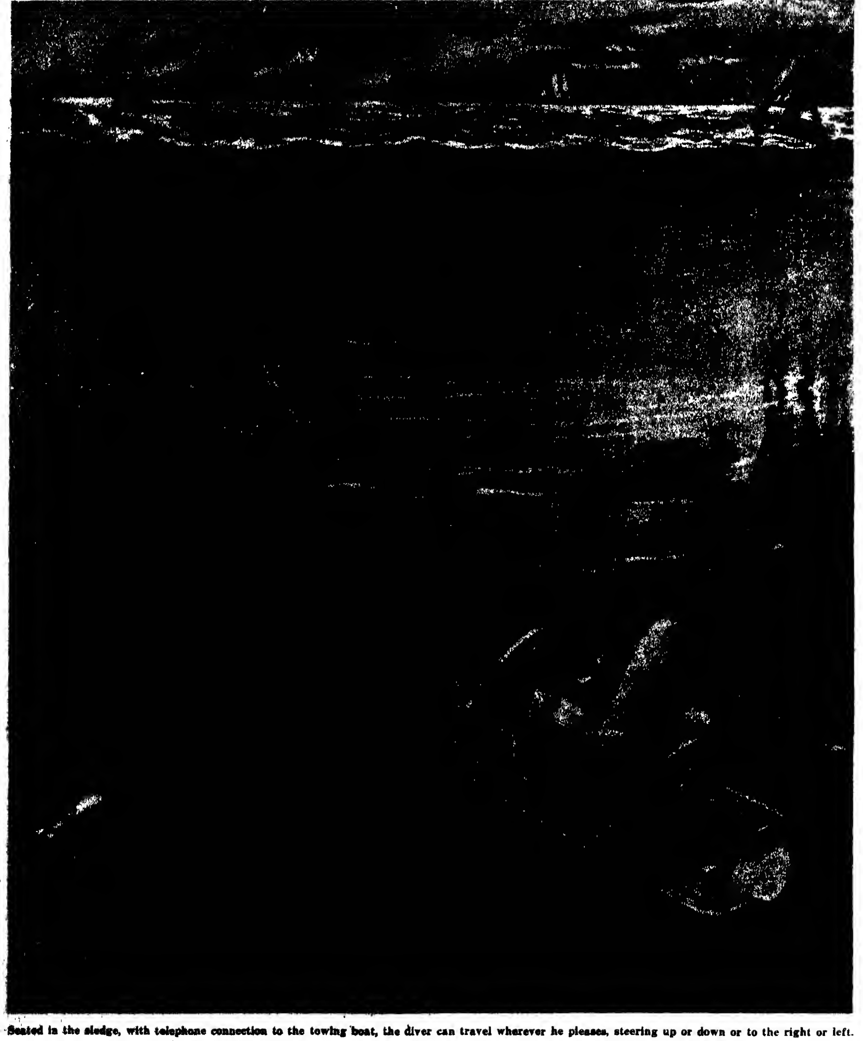
In Catholic countries the change was made in 1582 by direction of Pope Gregory XIII, when ten days were dropped from October and the 5th of that month passed as the 15th. Dates of events happening in those countries between 1582 and 1752 are sometimes given according to the New Style, and in that case the rule for the New Style would be used.

SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CVII. NUMBER 25.] NEW YORK, DECEMBER 21, 1912 [PRICE 10 CENTS $3.00 A YEAR



Seated in the sledge, with telephone connection to the towing boat, the diver can travel wherever he pleases, steering up or down or to the right or left.

THE SUBMARINE SLEDGE.—[See page 534.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, DECEMBER 21, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year . . .	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid.	4.50
Subscriptions for Canada, one year, postage prepaid.	3.75

The Scientific American Publications

Scientific American (established 1845) . . .	per year,	$3.00
Scientific American Supplement (established 1876) .	"	5.00
American Homes and Gardens . .	"	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Bursting of An Army 14-inch Gun

THERE is no branch of the mechanical arts in which the materials and the processes are subjected to more watchful scrutiny than in that of gun manufacture. Particularly is this true of the fabrication of guns of the larger calibers, such as form the principal armament of our battleships and fortifications. Conspicuous in its importance among the departments of a gun factory is the testing laboratory, whose staff of experts keep in touch with the progress of the gun through its various stages of construction, and where specimens, cut from the gun steel are subjected to chemical and physical tests. The system of tests begins in the stock yard, when the pig iron and general scrap which are to be melted down in the open-hearth furnace, are selected with a view to giving the molten steel the desired chemical composition. It is continued during the furnace treatment, specimens being taken from the bath for analysis, until the desired proportions of carbon and other constituents are obtained; and it is followed through the many processes of fluid compression, hydraulic squeezing or hammering, tempering, annealing and hardening, until the finished forging is completed.

Now the whole process of manufacture is closely watched by inspectors, and whenever the laboratory or other tests show that the material or workmanship is falling below the Government specifications the work is rejected. As the result of this close supervision, it is all but impossible for faulty material or poor construction to find its way into a finished, modern gun of large caliber.

Nevertheless it is conceivable that, hidden within one of the thicker hoops or other sections of the gun, there may exist some local flaw, invisible to the eye, but nevertheless constituting a menace to the safety of the gun of greater or less magnitude—a menace which can be detected only by putting the gun to the test of actual firing. It is chiefly for the purpose of giving the finished gun this final working test that such proving grounds as that of the army at Sandy Hook have been established. If any unsuspected flaw, undiscoverable to the eye, exists, or if there is any error in the calculations on which the gun has been built, it is necessary that it be developed before the gun is emplaced in a fortification. Hence every gun is sent to the proving ground, where it is put through a series of progressive trials commencing with small powder charges and advancing to and beyond the full charges which the gun is designed to use in service.

Occasionally a gun will burst under test. If this occurs, a board of artillery experts makes a searching examination to determine the cause. If the failure be proved to be due to the design, the design is modified.

The recent bursting of one of the new army 14-inch guns at Sandy Hook should not shake the confidence of the public in the quality of guns which have been built for our fortifications, for it is an assuring fact that, although there have been minor failures at Sandy Hook, due to defective powder giving abnormally high pressures, the blowing off of breech-blocks, the bursting of high explosive shells within the gun, etc., this is the first time that the gun itself has burst under test, during the several decades in which hooped, built-up guns have been tried out at this famous proving ground.

Big and costly though this 14-inch gun may be, this mishap must be regarded after all as a routine incident of the work at this post. During the past twenty years or more hundreds of guns of large caliber have passed through the ordeal which proved too much for this 14-inch piece, and until the Board of Inquiry has made its investigation and report we are justified in assuming that the defect which brought about the failure is peculiar to this particular gun, and not common to all the guns of 14-inch caliber.

The 14-inch gun, which was described in our Coast Defense number of May 18th, 1912, will form the principal arm for our Panama Canal and Philippine defenses. Already three guns of this general type have been tested. The original "test" piece, a wire-wound gun, was subjected to 47,000 pounds pressure, which is far beyond the service pressure of 38,000 pounds to the square inch. All these guns went through their trials satisfactorily. The gun which failed had been fired one round with a reduced charge giving 28,500 pounds chamber pressure. For the second round it was loaded with 355 pounds of powder, designed to give a pressure of 38,000 pounds. The men had all been sent behind the bomb-proofs, and Col. Babbitt and two other officers were in the open 250 feet from the gun, watching the target, when the gun burst. The massive fragments flew past the officers; but fortunately not one was injured.

Later, when the official report has been prepared, we shall hope to give the full particulars of what promises to be one of the most interesting explosions in the history of big gun construction.

Are Inventions Ever Willfully Suppressed?

BACK of all the agitation stirred up by Representative Oldfield is the notion that corporations are making a business of acquiring a number of inventions relating to an art and of manufacturing only one or two of them, and of suppressing the rest. During the twenty-six hearings which were recently held in Washington by the Committee on Patents to learn the views of inventors and manufacturers on the provisions of Mr. Oldfield's revolutionary patent bill, sales managers, lawyers, manufacturers, and advertising managers, were asked to mention specific instances of this practice. Even the few witnesses who were in favor of the bill were unable to do so. This vague impression, however, hung like a haze over the discussion until Mr. Thomas A. Edison, with the same keen insight that revealed to him the principle of the commercial telephone, the electric light, the phonograph and nine hundred other inventions, dispelled it with an analysis that was irrefutable. Mr. Edison stated:

"I have heard and read numerous statements that many corporations buy valuable inventions to suppress them, but no one cites specific cases. I myself do not know of a single case. There may be cases where a firm or corporation has bought up an invention, introduced it, and afterward bought up an improvement and *ceased using the first patents—suppressed* it, in fact. Why should that not be done? It is for the benefit of the public that it should get the latest improvement. I cannot see why the public should be asked to change the patent law to enable a competitor to get hold of the disused patent so that he can have a basis on which to enter into competition with a pioneer of the invention who has introduced an improved machine.

"Before any changes in the law are made, let the objectors cite instances where injustice has been worked on the public by the alleged suppression of patents for other reasons than those which were due to improvements."

Mr. Edison ventured the opinion that the law as it exists is fundamentally sound. "What is needed," he stated, "is not the making of any changes in the fundamental principles of the law, or lessening the consideration granted to an inventor for making his invention publicly known, thereby discouraging and hampering the inventor, instead of giving him encouragement. This proposed new law will discourage the inventor and will benefit the very men that it now seeks to restrain."

Such seems to be the opinion of all the manufacturers and inventors who appeared before Congress in opposition to the proposed patent legislation. And such seems to have been the more sober judgment of the last Congress, as evidenced by its determination not to press these proposals. Let us hope that if the bill is considered by the coming Congress, of which there seems to be every promise, the deliberate judgment of the entire manufacturing and inventing community, as well as of consumers and producers, will not be ignored.

The Status of Electric Cooking and Hot Water Supply

ELECTRIC cooking appliances—the shining nickel-plated or aluminium utensils, including coffee percolators, toasters, chafing dishes, each with its long connecting cord and plug for attachment to the electric light socket—are especially tempting, particularly at this holiday season. The question arises: Are these articles really economical in the present stage of electrical development?

Certainly electric cooking and heating represents an ideal. In the cooking and the hot water supply of the household the need is to get rid of fire risk, to improve the cooking itself, and to reduce the drudgery of housework. Electric devices offer these advantages. In the electric kitchen there are no matches to start a fire, there is no fire risk from the stove itself, there are no gas leaks or explosions. In the quick, perfectly controlled heat of the electric oven, the juices of a joint of meat are more perfectly conserved, and the meat loses less in weight than in any stove heated oven. In the large electric grill of a well-known New York club a thick steak, placed vertically between two incandescent walls, may be done to a turn in thirteen minutes; the heat sealing the surface of the meat at once and completing the cooking with no scorching, and with no flame to "catch" the fat as it drips down into a pan of water below. Since in the individual devices the heat is generated within the utensil itself the elimination of all smoking or scorching of the outside of the utensil lengthens its life and lessens the work of washing up after meals. One may do "light housekeeping" with a toaster and an egg boiler on the breakfast table and a chafing dish on the sideboard.

But the greater safety and convenience of electric cooking devices, their superior cooking quality, and the greater safety of electric hot water heating cannot be fully realized at present because of the high first cost of the devices themselves, their high operating cost as compared with gas or coal stoves, and the prejudice of servants against them as against anything new and unfamiliar. How can these obstacles be overcome?

As to the first cost of electric devices, it must be borne in mind that since each utensil comprises both the containing vessel and the heating element, the cost can never be as low as that of the ordinary kitchen utensil which it is designed to replace. A considerable reduction in cost may logically be expected, however, with increasing demand, following the present period of exploitation of the general idea of electric cooking and improvement of the devices themselves. The cost of operation is an element of the situation in which very great improvement may be expected. Just as the introduction of the electric light was not prevented or seriously hindered by the greater cost of the new means of illumination as compared with gas, so the advantages of electric cooking may be expected to prevail notwithstanding its greater cost—provided the difference in cost is not too great. To illustrate: it may pay better to toast ten slices of bread, electrically, on the breakfast table, at a cost of a cent than to make the same amount of toast in a slower and less interesting way on the gas stove, with the toast not so inviting or "piping hot," at a saving of a fraction of a cent. But apart from the convenience and economy of time, we may look forward to the time when increasing use of electric household devices will justify the electricity supply companies in reducing their rates for current—or introducing more generally the plan which already obtains in some cities, of selling current for heating and other household uses at a lower rate than current for lighting, each house being wired with a separate "heating circuit" with its own separate meter. The voluntary according of favorable rates will go further toward popularizing electric cooking in our homes than the present extensive boosting of the sale of the devices by advertising. Assuming the cost of electricity to be lowered sufficiently to take away the notion of electric cooking as a luxury, the obstacles presented by the prejudices of servants may be overcome by the fact that the intelligent housewife can get results by the new method and, therefore, can instruct her maid in doing so.

The problem of domestic hot water heating is brought nearer solution by recently developed ideas of using a small but continuous flow of electric current to generate heat which is accumulated or stored in the apparatus. The economy of this system depends on the taking of the electrical energy at those times during the twenty-four hours when the electricity supply companies can afford to deliver it at very low rates, that is in the "valley load" periods, and the success of the system requires the co-operation of the companies.

The Skull of Descartes

A VOLUME published by the Royal Academy of Sciences of Stockholm contains an interesting correspondence between Berzelius and Berthellot, from 1800 to 1822. From one of these letters we learn that the body of Descartes did not reach France in its entirety. A captain of the guards cut off the head and preserved the skull, on which he placed an inscription indicating its origin. The skull was very carefully preserved, and Berzelius sent it to Berthellot. The Academy in turn came into possession of it. Members of the Academy examined it, compared it with a portrait, and declared it genuine, or at least appeared to accept it as such. M. Deherain, the librarian of the Institute, has also undertaken to establish the authenticity of this anatomical relic. After long investigations he was able to discover that the skull of Descartes had been at one time confided to the Museum. It is supposed that the skull was placed in the anthropological collections, and that eventually it found its way to Sainte Genevieve.

Engineering

Stepless Cars in Favor.—The Public Service Commission has granted permission for the New York Railway to issue bonds to the extent of $640,000, the proceeds of which are to be applied to the purchase of 175 new cars of the stepless type recently described in the SCIENTIFIC AMERICAN.

Lattice Masts to be Retained.—As a result of the firing tests carried out some months ago against a lattice mast that had been erected on the "San Marcos," now lying on the mud in Chesapeake Bay, the Navy Department has decided to make the lattice or basket mast the standard type for future warships. The mast, under test, showed remarkable endurance, several successful hits being necessary to bring it down.

Diesel Engines with Electrical Reduction Gear.—The firm of Swan & Hunter are about to build a vessel for the Canadian lake trade of between five and six thousand tons, which will be driven by two 800 horse-power Diesel engines. A novel feature will be the insertion between the engines and the propellers of an electrical transmission system, of the same type that was successfully tried out on the steamship "Electric Arc."

Diminutive Dreadnoughts.—In view of the fact that our latest dreadnought, the "Pennsylvania," will displace over 30,000 tons, it is interesting to note that the Spanish are building a small dreadnought, one of three, which will be less than half her size, displacing only about 15,000 tons. On this displacement, however, she will carry eight 50-caliber, 12-inch guns, and 8 inches of armor and will have a speed of 19.5 knots.

Marine Engines Subject to Duty.—The act regulating Panama Canal tolls does not, as has been frequently stated of late, permit the importation of marine engines. The circular of the Treasury Department limits the materials which can be imported to unfinished forgings, plates and shapes, pipes and tubes of all kinds of metal, bolts and nuts and similar things, but not to any finished or assembled machinery which forms a part of the actual construction of a vessel.

Four-mile Tunnel Through the Selkirks.—At an estimated cost of over $12,000,000 the Canadian Pacific Railway expects within a few years to have opened a two-track tunnel, four miles in length, through the Selkirk range of mountains between Calgary and Vancouver. One object of the tunnel is to eliminate the ever-threatening possibility of interruption from snow-slides, which, on the present line through Rogers pass, have given a large amount of trouble. The tunnel will, of course, be operated electrically.

Question of Statues at Panama.—The suggestion has been made in the daily press that statues to Col. Goethals and Col. Gorgas be erected at Panama, one at each end of the canal. We appreciate the motive, but condemn the practice as here suggested; and we agree with our contemporary, the *Army and Navy Journal*, that it would not be well, even in the case of these officers, to violate the sound rule that monuments should not be erected to living men. The canal is their monument, and an appropriate bronze tablet would be sufficient.

To Depopulate the Canal Zone.—The census of the Panama Canal Zone gives the population there to-day as 63,810, of which about 42,000 are employees of the Canal Commission, the Panama Railroad and of the various canal contractors. Generally speaking, the soil is not suitable for farming. It is not likely that Americans will be attracted; and since other occupants than Americans, for obvious reasons, are not desirable, Col Goethals is in favor of the depopulation of the zone, except so far as it will be occupied by canal operatives and by the military necessary for the protection of the canal.

Death of Alfred Pancoast Boller.—We regret to record the death of Alfred Pancoast Boller, president of the American Institute of Consulting Engineers and one of the country's best known bridge builders, following a year's illness. He was seventy-three years old. Mr. Boller was a native of Philadelphia. He was graduated from the University of Pennsylvania in 1858 and received his engineering degree from Rensselaer Polytechnic Institute, Troy, N. Y., in 1861. He was chief engineer for the Hudson River Railroad for a short time. In 1870 he became vice-president and engineer for the Phillipsburg Manufacturing Company, and for twenty years he was employed by this company. During the same period he was consulting engineer for railroad building in Hayti and Cuba, chief engineer for the Manhattan Elevated Railway and consulting engineer for the Department of Public Parks of New York city. Mr. Boller entered into partnership with Henry W. Hodge in 1898, and they became consulting engineers for the Mexican National Railroad. The firm also was concerned in the construction of the 96th Street viaduct, New York city; the stone bridge over the Connecticut River at Hartford, Conn.; the Singer and the Metropolitan tower buildings and the Wabash Railroad entrance into Pittsburgh, and with the cantilever bridges over the Ohio and Monongahela rivers.

Electricity

A 900-Foot Wireless Tower.—To replace the tower of the German Wireless Company's station at Nauen, which was blown down a year ago, a new tower 917 feet high is being erected. It is expected to have a radius of 6,000 miles.

Snow on High-tension Transmission Lines.—In an article attacking the German requirements regarding aerial transmission lines, which hold that the accumulation of snow on the lines is proportional to the diameter of the wires, Dr. Maguene states that snow never collects on lines carrying 100,000 volts or more, even when they are not charged and are cold. This he attributes to electrostatic action.

New Leadless Storage Battery.—A Swedish inventor has put on the English market a new type of alkaline storage cell. The plates consist of inactive retainers which are loaded with active material, oxyhydrate of nickel mixed with graphite in the positives and finely divided alloy of iron and cadmium and certain other substances in the negatives. This new cell much resembles the Edison cell not only in the electrochemical reaction employed but in the fact that extreme ingenuity is employed in the mechanical construction to obtain high space and weight efficiency and durability.

A Coppered Incandescent Bulb.—A big tungsten bulb in a store window suddenly burned out and passers-by were astonished to note that the bulb took on the appearance of polished copper. Investigation showed that a thin film of copper covered the inner surface of the glass and formed a reflecting surface as fine as any silver mirror. The bulb hung vertically and the larger end was opaque, but the copper coating at the other end was thin enough to see through if held against a strong light. The explanation is simple. When the tungsten filament broke, a short circuit was produced on the copper supports, heating the copper until it vaporized (not difficult in a partial vacuum) The copper vapor coated the glass like so much dust, adhering more firmly, however. Atomized metals are now produced on a commercial scale for coating glass, wood and other objects. The usual procedure is to force the molten metal with a jet of steam against the object to be coated. The steam breaks up the metal into a very fine state of division and the particles adhere very well.

A Speaking Incandescent Lamp.—The incandescent lamp is not the mute electrical apparatus that we have always supposed it to be. It has just been discovered that given the right conditions it may be made to speak as readily as the arc, which for the last fifteen years has monopolized this accomplishment. According to *Physikalische Zeitschrift*, Messrs. K. Ort and J. Ridger have used a metal filament lamp as a telephone receiver. An Osram lamp of 100 candle-power is employed. The lamp is placed in a 120-volt direct-current circuit including a self-induction coil. Shunted across the two terminals of the lamp are a capacity and the secondary of a telephone transformer, the primary of which connects with a battery of five storage cells and a powerful microphone. Words spoken before the microphone are reproduced in the lamp. The discoverers of the speaking incandescent lamp explain the action on the principle that the telephonic current variations superposed on the current that passes through the lamp produce corresponding variations of heat in the filament, which radiating to the glass of the bulb, cause the latter to expand and contract proportionately and thus transmit the vibrations to the exterior air. This effect cannot be produced with 16 or 32 candle-power lamps because the glass is too thick and the heat variations too feeble.

Peace Between the Marconi and Telefunken Companies.—It is gratifying that the patent litigation which has for several years been pending between the two largest concerns in the field of wireless telegraphy, Messrs. Marconi Company in England and the German Telefunken Company, should, at last, have come to an end. It will be remembered that the two companies charged one another with interfering with their respective patent rights and contested the validity of their patents. There are no less than seven lawsuits of this kind pending in different countries. Now the Telefunken Company, with the agreement of the Marconi Company, has published in Germany the following statement. "Messrs. Marconi Company and the German Telefunken Company have agreed to cancel any patent litigation pending between themselves in different countries. The Marconi Company forego any intention of contesting the validity of such Telefunken patents as have been acknowledged by German courts, e. g., the Braun patents." Messrs. Marconi Company, with the agreement of the German Telefunken Company, has published in England the following statement: "Messrs. Siemens Bros. & Co., Ltd., who in England represent the interests of the German Company, have admitted the validity of the Marconi statement No. 7777 of 1900, arrangements being made for settling any mutual patent litigation pending between the two companies."

Automobile

New York's Shows.—The annual automobile shows in New York city will take place in January, on the following dates 2nd to 11th, show of imported cars in the ballroom of the Hotel Astor; 11th to 25th, double show of domestic cars in Madison Square Garden and the Grand Central Palace.

Ghent to Have a Six Months' Automobile Show.—In connection with the great international industrial exhibition which will be held in Ghent next year, and which will remain open for six months, the Belgian Motor Union will organize a collective exhibit of automobiles, motorcycles and aeroplanes.

Motorbuses Need Many Tickets.—The extent of London's motorbus traffic will be appreciated when one hears that no less than 200 tons of pulp are required to manufacture the tickets for one year's rides. It would be interesting to know how much the New York Subway consumes, because subway tickets, while much smaller, are much thicker than London bus tickets

Ventilating the Dash Hood of an Automobile.—George W. Dunham of Detroit has patented, No. 1,045,776, a ventilator which consists of a curved deflector embracing the upper edge of the dash hood of an automobile and suitably spaced with portions on both the inner and outer sides of the hood so that the air current induced by the motion of the car will be deflected from the outside of the hood to the inner side thereof to ventilate and cool the portion of the car immediately in rear of the hood.

Hemery Establishes New World's Records.—Victor Hemery, whose thrilling driving in American road races of the past four years is still remembered on this side of the Atlantic, on November 27th broke the world's record for six hours' continuous driving at the Brooklands track in England. At the wheel of a 90 horse-power Lorraine-Dietrich he covered 518 miles in the period at a sustained speed of 86½ miles per hour The former record was 451 miles in six hours

Segregating Show Cars According to Price.—Because the cheap and medium-priced car naturally suffers somewhat in comparison with very high-priced cars, especially when placed alongside of the expensive product, it has been suggested to divide automobile exhibits in the future according to price of cars, keeping the cheapest in one section, medium-priced in a second section and high-priced machines in a third section. Three separate buildings would be still better.

How a Lost Motor Was Found.—An unusual story of finding lost property comes from England. A repair shop received by express an automobile motor which was to be repaired, but the package contained no intimation of who the sender might have been In one of the cylinders an old copy of a British motor journal was found and the repairman promptly concluded that the owner of the motor was a reader of that paper. The story was sent to the paper and the owner got his motor back.

Would Charge $25 Admission to Automobile Show.—It has been suggested to charge an admission fee of $25 on a certain day of the next automobile show to be held at Olympia, London. The great crowds which throng the exhibition halls make it impossible for the intending purchaser to examine the cars closely and to get adequate information from the attendants On the purchase of a car on the floor of the exhibition, the admission fee would be refunded Losers under such an arrangement would naturally be the accessory dealers who cannot get along without crowds

British War Office Wants Motor Trucks.—The regulations for the tests which must be undergone by motor trucks submitted to the British War Department have just been issued The first set of tests, dealing in particular with the standardization and interchangeability of parts, took place in August last, and only two types of trucks succeeded in passing them. A new subsidy trial has been announced for February next, when motor truck manufacturers may submit their vehicles to the War Department's scrutiny As in the case of France, Germany, Russia and Austria, motor trucks which pass the test will be subsidized

Taxicabs Need Not Drive in Fog.—That a taxicab need not be driven in a typical London fog, and that the would-be passenger, after being taken for part of the agreed distance, must pay for the mileage covered, is the decision of a London justice As the story comes from England, it cost the motorist 11 shillings and 8 pence to find it out, while the original taxicab bill had only been 1 shilling and 2 pence. A taxicab driver had been engaged to drive from St. James' to St. John's Wood, but at Clarence Gate the fog was so dense that the driver could not see the hood of the motor. He stopped and refused to drive any farther, claiming it to be too dangerous. The taximeter registered 1 shilling 2 pence, and the passenger refused to pay. The matter was carried to court with the result that the "taxi" was complimented by the judge on his good sense and the passenger ordered to pay the fare and costs.

The Death of Prof. Sir George H. Darwin

PROF. SIR GEORGE H. DARWIN, M.A., F.R.S., LL.D., D.Sc., who died recently, was the second son of Charles Darwin, the great naturalist. The Darwin family for generations has included men distinguished in the arts and sciences; and while the originator of the Darwinian theory, one of the most eminent investigators and thinkers England has ever produced, unquestionably overshadowed the others, it has not been through his reflected glory that his sons took their deservedly prominent position in the world of science.

Sir George H. Darwin was born at Down, in Kent, England, in 1845. He was educated under the Rev. Charles Pritchard, who subsequently became a Fellow of the Royal Society, and the Savilian Professor of Astronomy at Oxford. In 1864 George Darwin entered Trinity College, Cambridge, from which he was graduated in 1868 as Second Wrangler and Smith's Prizeman. From 1868 to 1878 he was a Fellow of Trinity College, and was re-elected in 1884. He studied law, and was admitted to the bar in 1874, but he did not subsequently practice that profession.

In the following year he returned to Cambridge, and devoted his entire time to the study of the mathematical and astronomical sciences, and particularly to experimental investigations on the pressure of loose sands, on changes in the level of the earth's surfaces, and on minor earthquakes. His interest in astronomical and meteorological studies and investigations had been aroused prior to this, and in 1870-71 he accompanied the English expedition to Sicily to observe the eclipse which occurred during that period. In 1882 Prof. Darwin assisted Sir William Thomson (Lord Kelvin) in the preparation of a new edition of Thomson's and Tait's "Natural Philosophy," and in the following year was appointed Plumian professor of astronomy and experimental philosophy at Cambridge, succeeding the Rev. James Challis, M.A., F.R.S., to a chair which Prof. Darwin held with distinguished success. From 1885 to 1905 he was a member of the Council of the Meteorological Office of Great Britain, and he served on the Meteorological Committee of 1905. He was chosen a member and later, in 1879, a Fellow of the Royal Society. He was a president of the British Association for the Advancement of Science, and as the head of that association, he formally opened the Victoria Falls Bridge over the Zambesi Gorge in Central Africa in September of last year. In 1885 he received "a royal medal" from the society for his scientific work, and also one from the Royal Astronomical Society.

Prof. Darwin was an honorary graduate of the universities of Glasgow, Dublin, and Padua, as well as a member of several British and foreign academies of science.

Prof. Darwin's published contributions to scientific literature include papers on consanguineous marriages, for the Statistical Society; jointly with his brother on Small Deflections of the Plum Line Due to Movement of the Earth, British Association Report; a series of reports to the British Association on Harmonic Analysis of Tidal Observations, 1883 and later; several papers on the same subject in the Proceedings of the Royal Society; a series of memoirs on the Effects of Tidal Friction on the Earth and on the Moon, Philosophical Transactions of the Royal Society; papers on subjects cognate to the last, and on Figures of Equilibrium of Rotating Masses of Fluid and on the Mechanical Constitution of a Swarm of Meteorites, Philosophical Transactions of the Royal Society; a paper on Periodic Orbits, in 1896; and one on the Tides and Kindred Phenomena in the Solar System, 1898.

To Our Subscribers

WE are at the close of another year—the sixty-eighth of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

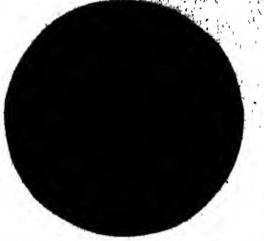
Removing Acid Stains from Instruments

A GOOD method of removing acid stains from laboratory instruments is to rub with pearl ash and then boil for a few minutes in soap water. The instruments should then be dried in magnesia powder and polished with a dry cloth.

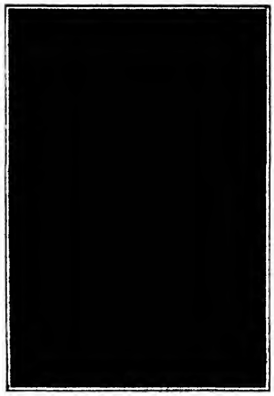
Capturing Frost Flowers

By S. Leonard Bastin

THERE must be few people who have not admired the exquisite patterns which Jack Frost traces



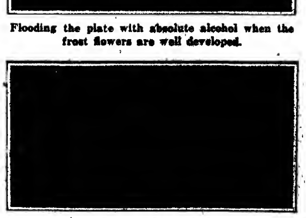
A captured frost pattern in gelatin.



Smearing the piece of glass with the gelatin solution.

The glass should be supported on a cup placed out of doors in freezing weather.

Flooding the plate with absolute alcohol when the frost flowers are well developed.



A captured frost flower.

with his icy fingers. The thought is inevitable, that it is a great pity the charming forms are not of a permanent nature. It is all the more interesting to be able to bring forward a scheme whereby it is possible to secure lasting records of the ice flowers. This is so simple that anyone can carry it out with good hopes of success, and in this way provide one's self with an absorbing pastime for the winter days.

The frost patterns are most satisfactorily secured on pieces of glass. Before proceeding it is important to see that these are quite clean, and free from any grease. In passing it may be mentioned that a very good glass cleaner is methylated spirit, rubbed on with a piece of crumpled-up paper. Next prepare, or get the druggist to make up for you a solution of two per cent clear gelatin dissolved in distilled water. Also secure a small quantity of absolute alcohol; a few ounces will be all sufficient for the purpose. It is well to get all these things ready in advance, before any attempt is made to take records of the frost flowers.

At a time when there are at any rate several degrees of frost out of doors, we may make the first trial at securing the ice patterns. It is, of course, understood that the gelatin solution, the spirit, and the plates of clear glass, are to hand. If the weather is cold it is likely that the gelatin will be in a partially solidified condition, and in order to make it ready for use it may be necessary to place the bottle in a bowl of warm water for a few moments. When the mixture is fairly liquid a quantity of it may be smeared over a sheet of glass. This is perhaps best accomplished with a good sized brush. In any case it is important that the solution should be spread over evenly, and be quite free from air bubbles.

The best results are secured when the freezing process is as rapid as possible, and it is desirable to support the glass so that it will be in a very exposed position. To bring this about a good plan is to raise the glass on an inverted cup in the manner indicated in the accompanying illustration. Even in a comparatively slight frost, if the glass is placed in this way, a few inches above the level of the ground, the chilling influences of the air will speedily begin to make themselves felt.

It is well to watch rather closely the action of the frost on the gelatin solution. The freezing process should not be arrested until the pretty flowers are well developed, although on the other hand if the action is allowed to continue for very long, the pattern will become too involved for the best effect. When it is considered that the design is at its best, the glass may be taken into a cool room for further treatment. No delay is permissible, as the pattern will, of course, rapidly fade away in a warm atmosphere.

Place the glass in some kind of a dish and immediately flood the plate with the alcohol. For about two minutes rock the dish backward and forward, so as to insure that every part comes under the influence of the spirit. Eventually it will be found that the alcohol will have entirely removed the ice, leaving behind a permanent formation of the gelatin which may, without difficulty, be preserved for an indefinite period. The best way in which to protect the gelatin, which otherwise would be likely to be affected by atmospheric moisture, is to cover it with a film of clear varnish. This should be applied with a good deal of care in order that the beautiful ice flowers may not be disturbed.

The best results will be obtained if a number of attempts to secure the patterns are made. Thus the sheet of glass may be put out of doors, and if the resulting pattern is not very good, the gelatin solution should be cleaned off and another trial be made. In this way we may be quite certain of getting some very fine pictures. By a few experiments of this nature it will be easy to discover how far the freezing process should be allowed to go.

Of course these captured frost flowers will make the most beautiful transparencies, and as such may be used in the form of window ornaments. Apart from its fancy side the idea has a useful object, as large pieces of glass which could be used for putting in windows may be frosted with real ice patterns. Wherever an undesirable view needs blocking out the result is at once useful and highly decorative. If liked, the effect can be very much enhanced by coloring the gelatin in some bright tint. For this purpose any aniline dye is very useful, the substance being mixed with the gelatin before this is placed on the glass. Most of the brightly colored inks which are commonly sold are practically solutions of aniline coloring, and as such may be used with effect for this particular purpose.

Walter Johnson on October 31st broke the American aeroplane endurance record for a flight with one passenger. He flew a Thomas biplane, and remained in the air 3 hours, 51 minutes and 12 seconds, covering a distance of 285 miles. The course lay between Savona and the village of Bath, New York. The average altitude was about 650 feet.

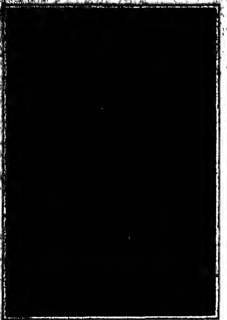


Fig. 1.—With the Bélin apparatus it is possible to transmit photographs over a telephone line to a distant receiving station.

Fig. 2.—The receiving apparatus. A_1 is the oscillograph; B_1 is the photographic frame in which the receiving cylinder is held; C_1 is a lens combined with which is a series of screens; M_1 is an electric motor that drives the apparatus.

Fig. 3.—A portrait transmitted by the improved Bélin telephotographic apparatus in four minutes over a telephone line of 450 miles.

Sending Photographs Over a Telephone Wire

The Improved Bélin Apparatus

By Jacques Boyer

A FRENCH physicist, M. Edouard Bélin, whose remarkable work in telephotography was described in the SCIENTIFIC AMERICAN of December 21st, 1907, and June 12th, 1909, has invented a portable telephotographic apparatus. The new apparatus, remarkable for its small size and weight, constitutes a complete transmitting station, which can be connected up with a convenient telephone line in order to transmit pictures to a distant receiver.

In the so-called carbon process of photography, invented by Poitevin, photographic positives are made on paper coated with sensitive bichromated gelatin, which, as every one knows, becomes insoluble when exposed to light. When the print is taken from the printing frame, it is washed in hot water, the gelatin dissolving more or less, according to the variations in opacity in the negative. As a result the positive obtained consists of reliefs and depressions corresponding respectively with the whites and blacks of the original negative. The halftones lie intermediate between the maximum elevations and depressions.

The bichromate gelatin proof thus obtained is wrapped around the cylinder A of the portable telephotographic apparatus (Fig. 4), which is rotated by a powerful spring motor in the drum B. The spring, which can be wound up by means of a crank visible in the photograph, also drives through multiplying gears a governor R, the purpose of which is to maintain the speed of the cylinder's rotation at a constant number of revolutions. The cylinder's speed is also controlled by means of the graduated index immediately behind the pane of glass at the front of the apparatus. A milliampere-meter M is mounted to the left of the apparatus.

As the cylinder A rotates, a rheomicrophone C is made to travel parallel with it by means of a screw, the principle being much the same as that embodied in the Edison phonograph. The rheomicrophone C consists of a frame, box-like in form, the bottom of which consists of an insulated plate, and the cover of which is a flexible conducting sheet of carbon, serving the purpose of translating the variations in relief on the cylinder into currents of different intensity in the line. To carry out that purpose resistances conveniently divided into ten stages are arranged on the insulated plate. The current from a small battery is received by the first resistance, always in contact with the conducting plate, and then flows through the wire attached to the last resistance. Depending upon the amount of pressure to which it is subjected, which pressure is governed by the hollows and elevations of the bichromated gelatin, the conducting plate bends more or less and touches a variable number of resistances, the number increasing with the impulsive force received. Hence currents of successively different intensities are sent through the line. Microphonic contacts are employed in order to obtain better results in the transmission of photographs. It would require entirely too much space to describe in detail all the elements of this portable telephotographic apparatus. It may be stated, however, that perfect synchronism is obtained between the transmitting and receiving cylinders. For the purposes of this article we must proceed to a description of the manner in which the apparatus is utilized.

Fig. 4.—The improved Bélin telephotographic apparatus. A is the cylinder on which the original picture is wrapped; B is a drum inclosing a spring which drives the cylinder; C is a rheomicrophone; R is a governor that controls the speed of the cylinder.

Fig. 5.—The receiving cylinder of the Bélin apparatus. The casing has been removed in order to show the picture that has been received.

After the gelatin bichromate print has been wrapped around the cylinder, it is merely necessary to connect the apparatus with a telephone line. At the receiving station the telephone wires are connected with a large Bélin telephotographic apparatus, on the cylinder of which sensitized paper is wrapped on which the picture is to be received. The paper is protected by a kind of hexagonal photographic frame.

All is now ready for the transmission of the photograph. The operators first exchange the necessary signals and synchronize their respective cylinders. The transmission of the photograph does not in any way interfere with the regular use of the telephone line.

At the receiving station a Nernst lamp is employed as a luminous source. Its rays are projected on the sensitive surface, which is to receive the picture, by means of a Blondel oscillograph. The oscillograph consists of two large coils between which a mirror oscillates. The movements of the mirror are proportional to the intensity of the currents received. The pencil of rays emitted by the Nernst lamp is reflected in a little mirror; then the rays pass through a small aplanetic lens C_1 in connection with which the inventor uses a series of graduated screens that enable him to pass from complete transparency to complete obscurity. The receiving cylinder, which is identical in size with that of the transmitting station (Fig. 5), is driven by an electric motor M_1, mounted beneath the table on which most of the apparatus is carried. The motor is very carefully synchronized with that of the transmitter by means of a special rheostat. The cylinder of the receiver, indicated by B_1 in Fig. 2, and shown in detail in Fig. 5, is mounted in a wooden casing. This casing has a circular opening one third of a millimeter in diameter, through which the luminous rays enter. The walls of the casing are

(Concluded on page 543)

The Pier Problem at the Port of New York

How Manhattan Has Encroached on the Hudson River

IT is probable that few people outside of the historian and the Dock Commissioners have any conception of the great extent to which the bulkhead line of New York city has encroached upon the Hudson and East rivers. They will be surprised to learn that since the year 1626, when the West India Company purchased Manhattan Island from the Indians for sixty guilders, a sum equal to about twenty-four dollars at the present day, the shore line below Chambers Street has been gradually pushed out by bulkheading and filling in, until the area of the island below Chambers Street is approximately 75 per cent greater than it was some three hundred years ago.

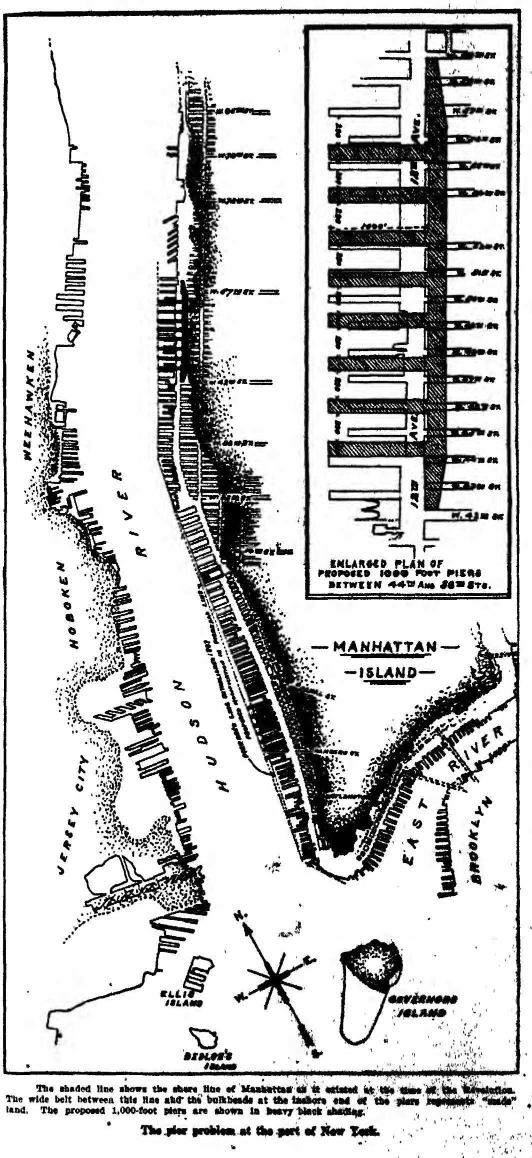
At the present time, when the question of bulkhead and pierhead lines along the Manhattan shore fronting on the Hudson River has come up for another and probably its final determination, particular interest attaches to the accompanying map, which shows, by a shaded line, the original shoreline of Manhattan and Jersey City, or rather the shoreline as determined by a survey made at about the time of the Revolution, and also the location of the present bulkheads and pierhead lines, and the proposed modification of the pierhead lines which is suggested by the city authorities and the Governor of the State, and for which Federal sanction is now being sought in a bill before the House presented by the Governor-elect William Sulzer.

The original shoreline as shown on our map is approximately that which was established by nature, with the exception perhaps of some slight encroachments which took place at the lower end of the island in the days of the original city of New Amsterdam. The water adjoining the highwater line was more or less shoal, the underwater profile of the bottom of the river sloping more or less gradually to deep water; and the motive for encroachment upon the river and bay during the past 300 years has been the same—the desire to provide deep water and pier accommodations for shipping. Moreover, as far back as the seventeenth century, it was realized that the rapid currents of the Hudson and East rivers had to be guarded against, and as early as 1654 it was resolved to drive planks into the shore to make uniform "sheet piles" between Broad Street and City Hall, for the lower part of the city. Several ordinances bearing on the subject of the water front were passed, but the act in 1654 was the first formal attempt to construct a statutory bulkhead. Another motive for the encroachment was the natural desire to increase the area of Manhattan Island. To what an extent this has been achieved a cursory glance at the accompanying map will show.

The bulkhead line along the Hudson River was established by statute in 1871, 1897 and 1904, this last relocation being made between West Twelfth and West Nineteenth streets to accommodate the new Chelsea piers. The pierhead line was first established by statute in 1857. There was a revision in 1890, and the present line was established in 1897. The lines have been carried farther and farther out into the river, to accommodate the ever-increasing growth of steamships. Just how large this encroachment has been will be understood, when it is stated that the present pierhead line between Pier 1 and Fifty-ninth Street is from 1,000 to nearly 2,000 feet beyond the original shoreline of Manhattan, this last figure obtaining in the neighborhood of Twenty-ninth Street, where the original shore line lies fully 1,500 feet inshore from the present bulkhead line. If, in the future, this city should decide to excavate back into the shore to accommodate the larger ships that will be built, it will merely be restoring to maritime uses areas which formerly were covered by the waters of the Hudson River.

The cause of the present persistent agitation is to be found in the natural desire of the Port of New York to accommodate the ships of unprecedented length which are now being constructed. That fast merchant ships will tend to grow larger, and that the 1,000-foot ship will appear within the next few years, is rendered certain by the economic fact that the larger the ship the less is the cost of carrying a ton of freight or a given number of passengers.

There are two ways in which accommodations can be found; one by a yet further extension of the pierhead line into the river, the other by maintaining the present pierhead line and excavating back into the shore. Several boards have been appointed to look into the question. The Board of Estimate has approved two of the plans suggested; one of which will meet the more immediate and pressing needs of the near future, while the other will make provision for the further increase in the length of ships which may occur during the next two or three decades. Both of these plans are shown upon the map which is herewith published. The first plan, for meeting the immediate situation, calls for a straightening of the pierhead lines between the Battery and Thirtieth Street; a relocation which would make it possible to build between these points some twenty piers, varying in length from 920 to 1,040 feet. The present bulkhead line curves gently inshore between these points, and the running of a straight pierhead line would not narrow the fairway of the Hudson River below the minimum width, which occurs opposite Castle Point on the Jersey shore. The other scheme approved by the Board of Estimate calls for the construction, as they are needed, of piers of from 1,000 to 1,200 feet in length between Forty-fourth and Fifty-sixth streets, the necessary depth to be obtained by excavating inshore. It is the opinion of the SCIENTIFIC AMERICAN that it would be a wise provision for the city to purchase the whole of the blocks lying between Twelfth and Eleventh avenues, between Forty-fourth and Fifty-sixth streets. This would provide accommodation for piers of 1,500 feet length, should future developments in shipping call for them. In this connection mention should be made of the admirable plan of Dock Commissioner Tomkins for an elevated terminal railroad, to extend from Fifty-ninth to Cortlandt Street, with spurs running out onto the piers, and with connections to terminal freight buildings, erected on suitable locations adjacent to the railroad. The construction of this line, together with the straightening of the pierhead line, and the purchase of the property between Forty-fourth and Fifty-sixth streets, would place the port of New York in an unrivaled position.



The shaded line shows the shore line of Manhattan as it existed at the time of the Revolution. The wide belt between this line and the bulkheads at the inshore end of the piers represents "made" land. The proposed 1,000-foot piers are shown in heavy black shading.

The pier problem at the port of New York.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Flight of Projectiles

To the Editor of the SCIENTIFIC AMERICAN:

In criticising an article on the flight of projectiles, by Rear Admiral Twining, a correspondent in your issue of October 5th complains of the comparison of the twist of a base-ball to the twist of a bullet, on the ground that "a base-ball is rotated on an axis more or less at right angles to its trajectory, whereas a projectile is rotated on an axis practically identical with its trajectory."

If a projectile rotated on an axis absolutely identical with its trajectory, the criticism would be sound, but it is just the slight departure from this condition that causes the drift. The moment the projectile leaves the gun, the force of gravity begins to pull it away from the path of the axis of its rotation, and this slight deviation is enough to make the analogy of the base-ball applicable.

The late Major Lissak, while Instructor of Ordnance at West Point, showed me an apparatus he had constructed to illustrate the drift of a projectile in flight. He had a spheroconical shell mounted in gimbals, so that it could be rotated rapidly and was free to turn in any direction. The resistance of the air to the forward flight was simulated by a hose from a compressed-air tank. Upon directing an air current directly at the point of the rotating projectile, no change in its position occurred. Upon directing the air slightly below the point of the shell, to imitate the resistance due to the fall of the projectile from the prolongation of the axis of the gun, the point of the shell immediately turned to the right. Upon directing the air from this quarter to imitate the resistance to this new movement, the point of the shell immediately turned down. This seemed to demonstrate that the same resistance which caused the drift, further operated to make the projectile follow its point.

SIDNEY BALLOU.

Washington, D. C.

The Self-contained Diving Outfit

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the 5th of October there appeared a notice of a self-contained diving outfit. From the description, the lay-reader would infer that the idea was a new one; this, however, is not the case. There is absolutely nothing novel in the device as described, as you will see on referring to pages 25 and 26 of our catalogue, a copy of which we are sending you by this post. Comparison of the illustrations in our catalogue, which was published three years ago, with that which appeared in your journal will show you the similarity. And further to emphasise the lack of novelty in the apparatus in question, we would mention that we introduced the first apparatus on this principle nearly thirty-four years ago. Used by one of our divers so long ago as the year 1880, it was instrumental in saving the flooded Severn tunnel (*vide* report herewith). See page 172 of "Diving Manual," which we also send you.

Knowing the reputation of your valuable journal, we feel sure that you will give publicity to our statement, and so remove any false impression that may have been formed in the minds of your readers. Just as our Fleuss self-contained breathing apparatus for use in irrespirable atmospheres, introduced by us thirty-five years ago, was the first practicable apparatus of the class using compressed oxygen and caustic potash as revivifying agents, so our original Fleuss diving apparatus (much improved in recent years) must be regarded as the prototype of self-contained diving outfits.

SIEBE, GORMAN & Co., Ltd.

London, England. R. W. DAVIS, Director.

[The catalogue and manual have been received and bear out the contentions of our correspondent.—EDITOR.]

How Would You Converse With Mars?

To the Editor of the SCIENTIFIC AMERICAN:

Suppose that it had been once and for all determined that Mars is inhabited; that signal flashes sent from either the Earth or Mars had been answered by corresponding flashes. How would it be possible to formulate a code which would enable the inhabitants of Mars or the Earth to communicate with each other intelligently? In other words, how could we learn something of the history and the manners of Martian people, and how could we impart to Martians some knowledge of our own political and industrial affairs? It is all very well to send signal flashes through space, but unless we agree upon the significance of the flashes, how will we ever be able to learn something of the personalities of Martians?

It has occurred to me that perhaps we might make a beginning with the representation of geometric figures. If the Martians are intelligent enough to send us signals through space, they are presumably intelligent enough to understand geometry and to recognize the characteristic diagrams of well-known geometric theorems. Thus, waving aside all technical difficulties, suppose we covered a considerable portion of the earth with a huge diagram that would illustrate the theorem: *The square on the hypotenuse of a right-angle triangle is equal to the sum of the squares on the other two sides.* The Martians might reply by exhibiting to us a diagram that would illustrate another theorem in Euclid, thereby showing that they understood at least the principles of Euclid.

Even with this beginning I find it difficult to imagine the next step. Perhaps some of the readers of the SCIENTIFIC AMERICAN may be able to suggest methods whereby the President of a Martian republic could felicitate the President of the United States on the three hundredth anniversary of the signing of the Declaration of Independence.

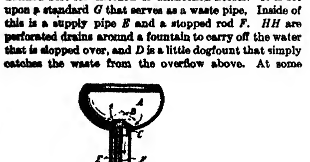
W. K.

New York, N. Y.

Sanitary Horse Troughs

To the Editor of the SCIENTIFIC AMERICAN:

It has been found that the horse trough has proven a prolific means of carrying infection. Hundreds of horses have taken glanders and all sorts of things *via* that means. Not that the horses touch the iron part of the trough and leave germs there, but simply that a healthy horse drinks immediately after a diseased one and gets the germs, spume, etc., left in the water by the other. The idea suggests itself that the horse be given a hygienic drinking fountain, as is provided for us humans. We can't expect a horse to put his mouth over a little stream shooting in the air, but the device that is roughly sketched herein will do the trick of giving the horse an individual drinking fountain. *A* is a drinking fount of sufficient size to hold a normal drink for a horse, and set high or low as deemed best for checked or unchecked horses. It is set upon a standard *G* that serves as a waste pipe. Inside of this is a supply pipe *E* and a stopped rod *F*. *HH* are perforated drains around a fountain to carry off the water that is slopped over, and *D* is a little dogfount that simply catches the waste from the overflow above. At some



Sanitary fountain for horses.

point near the fountain, where a horse has to place his front feet in order to drink from the fountain, would be a platform device *J*, not unlike a scale platform. Normally, the stopper *C* is in position *D* and the fount is dry. By a simple system of levers, etc., when a horse approaches to drink he is bound to get his front feet on *J* (that yields sufficiently to operate the mechanism, but not enough to bother or fuss a horse) which closes down stopper *C* and opens the valve in *E*, and as long as he stands there that valve is open and the water is running. When he leaves that position the water is closed off, the stopper rises, and the fount is empty of any residue water. Each horse gets a drink of fresh, clean water and the tank is flushed after every drink. The saving of water over the continuous running tank is also an item in its favor. Plus which, it is an anti-freezing fountain. The water valve can be, as in most hydrants, well below freezing and a self-drainer; and there being no water left in the tank, it is a fount that can be kept in operation all winter. And it would be a simple enough matter to so protest *J* that that mechanism wouldn't necessarily fill with water and freeze.

Washington, D. C. F. W. FITZPATRICK.

How are Trees Splintered by Lightning?

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 3rd, 1912, under the heading of Correspondence I noticed a letter from Mr. Austin P. Nichols, entitled "A Notable Lightning Stroke," the point which interests me is in his sentence: "The splintering of the enormous pine tree could well be accounted for by the instantaneous development of steam from the sap in the wood in connection with the air in the tissues caused by the sudden heating by the current."

Now I have actually witnessed the striking by lightning of an "iron-bark" tree which has been ring-barked and dead for thirty years. This particular wood, as is well known, is one of the soundest and hardest in the world when seasoned for so long. The effect of the lightning on this tree was to blast it into hundreds of pieces, the largest weighing no more than ten pounds, from the topmost branch to within eight feet of the ground. It was a tree 70 or 80 feet in height, and the pieces were thrown in every direction, some as far as 160 yards from the base of the tree.

A dead and seasoned "iron-bark" has no sap, and as there was no rain, it being a dry storm, the theory of sudden development of steam would not account for the blasting.

Then, again, the amount of heat necessary to expand the air in the tissues of the tree would have to be terrific, and there was not the slightest sign of burning or scorching. On the other hand, I have seen lightning strike a tree and simply ignite it without blasting it into pieces.

Thus it is reasonable to suppose that Mr. Nichols's statement will not explain my example. I have never heard a satisfactory explanation of the case. Is there one?

T. KINGSMILL ABBOTT.

Murralla, Wingen, New South Wales.

Free Will Versus Determinism

To the Editor of the SCIENTIFIC AMERICAN:

I wish to refer briefly to the letter of J. L. Stinson in your issue of October 12th. His observations had for their text the quotation from Dr. Johnson: "All theory is against the freedom of the will, and all experience is for it."

While the statement that all theory is against the Freedom of the Will is decidedly untrue, the second part of the quotation, if reasonably interpreted, must remain an irrefragable proof for Free Will against the arguments of the Determinists. Nor can any scientific or philosophic mind accept the pseudo-parallel argument about the rotation of the sun around the earth, proposed by Mr. Stinson, as disproving the legitimacy of Dr. Johnson's conclusion from experience.

The experience which forces a reasonable man to conclude that he has a Free Will is immediately connected with his inner consciousness. And in purely deliberate actions, such as that of mental attention in recalling the incidents of a past experience or in considering the motives for and against a certain line of action, the evidence for freedom in guiding the mind's activity is so powerful that no one can resist it without mental violence. Anyone can perform an experiment of this kind. The process is so simple and clear of detail, that confusion of experience with inference is impossible. On the other hand, to deny that consciousness is a reliable witness for truth would clearly make all scientific knowledge impossible.

The so-called experience for the sun's revolution is so indirectly and remotely related to consciousness and so irrelevant to the plan of argument that nothing further need be said about it.

Freedom of Will in man is by no means unthinkable, except for those who assume, without warrant, that the theory of materialistic Monism is a proven fact. *A priori* conclusions from unestablished premises are anything but scientific. Ardent pursuers of this method are uniformly unfair to opponents and uncandid in their use of evidence.

It is unfair to say that the advocates of Free Will would make man's actions motiveless. The very opposite is true. They hold that the Will of man is a rational appetency, and simply cannot act without a motive under some aspect of good. They deny, however, that any motive of finite goodness necessarily compels the Will to act. No matter how preponderant the algebraic resultant of motives, measured in terms of pleasure or here-and-now advantage, may be for a certain line of action, the Will may hold out against consent at the expense of great pain. No one could seriously maintain, against the clear testimony of his consciousness in such cases, that he would not be perfectly free to follow the easier course of action.

It is possible and safe to predict how the average man will act under set conditions, because, first, as a matter of fact, very many of man's outward actions are indeliberate, and so are only the response to impulse; and second, as a matter of experience, the deliberate actions of the average man will for the most part be in the line of the algebraic sum of motives, though none the less free for that. These facts, and not the postulates of Determinism, are the basic supposition of social and economic regulations.

The difficulty presented to Determinism by the moral order deserves more serious consideration than the jaunty contempt of Mr. Stinson. The conviction of moral obligation, of responsibility, of merit and desert for deliberate actions, is a fact of inner experience common to all mankind. This appears with the dawn of reason in the individual, and is utterly incompatible with anything save a real freedom of action.

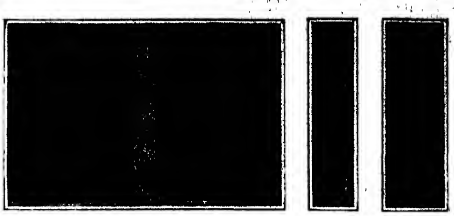
To say that all contribution to advancement in education and social reform has been made on the supposition of Determinism as against Freedom of Will is a purely unsubstantiated assertion, and is in nowise strengthened by the corroboration of one whose claim to authority arises from valuable work in another field.

For a detailed discussion of Free Will and Determinism I would refer anyone who is interested to the admirable work of the English psychologist Maher. ("Psychology," Longmans, London and New York.)

St. Louis, Mo. W. H. AGNEW.

Solution of the Steel Rail Problem

A Method of Producing Sound Ingots



Longitudinal and cross sections, showing defects in typical American ingots.

DURING the winter months of 1906 to 1907, there was such an alarming increase in the number of broken rails on railroads that the State Railroad Commission of the State of New York made an investigation and published a report which covered the winter months of 1905, 1906 and 1907. The alarming facts were brought out that the number of broken rails removed from the tracks in 1905 amounted to 1,178, in 1906 to 804, and in 1907 to 2,899, the increase in the number of broken rails in the State of New York in 1907 over those in 1906 being, therefore, about 360 per cent.

The SCIENTIFIC AMERICAN at that time made a careful investigation of the subject, in the course of which every facility was afforded, both by the engineers of our largest railroad companies and by the leading manufacturers of steel rails. The investigation was made by the Editor in person, and he was given exceptional facilities for examining the private records of the railroads and the minutest details of the process of manufacture by the railmills. The engineers of the railroads stated that they were anxious to secure rails only of the very highest quality, and that, if it should be shown to be necessary, they were willing to pay the highest price which might be demanded for producing rails of the desired composition, strength and wearing qualities. He found that the manufacturers, on the other hand, emphatically declared that, subjected to the conditions imposed by the limitations of the Bessemer process and by the necessity of running their mills at the fullest capacity, in order to meet the enormous demand for rails, they were making the very best possible rail that could be produced. At that time rails were made almost entirely from Bessemer steel, and it was urged that if the open-hearth process were used, it would be possible to secure sound ingots and reliable rails.

Cross sections of American rails, showing how defects in ingots appear in the finished rail.

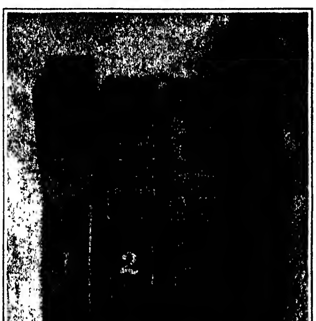
The SCIENTIFIC AMERICAN found that the deterioration in the quality of the rails in those days was due to the inferior quality of the steel used in their manufacture, and that the inferior quality was due to two facts; First, that the ore from which the steel was being made contained a larger amount than formerly of an impurity which could not be removed by the Bessemer process, and, second, that the manufacturers were using a portion of the steel ingots from which the rails were rolled, which formerly, under the more stringent specifications of the railroad engineers, was rejected and scrapped—this being the upper portion of the ingots containing the deep cavity, or pipe, from which most of the mischief arose. The engineers claimed that broken rails came chiefly from that portion of the ingots which formerly was rejected under their specifications, but which the mills were now incorporating. They stated that, if a larger portion of the imperfect upper portion of the cast ingots were rejected, it would be possible, in spite of the depreciation in the quality of the ores, to roll a rail which would stand fairly well up to its work. On the other hand, the manufacturers understood that if a one third or a one quarter crop were made from the top of the ingots, it would mean an immediate and very large reduction in their output, a reduction which, because of the increasing demand for rails, they were unwilling to make.

We suggested at the time that the proper solution of the difficulty would be to make the one third crop as requested; roll rails of the very highest character that could be secured under the Bessemer process, and in order to meet the slowing down of the speed and the shortage of the supply that would result from these improvements in manufacture, to remit the duty on steel rails until such time as the railmaking concerns should have been able to build up and set in operation sufficient open-hearth plants to supply the full demand of the country.

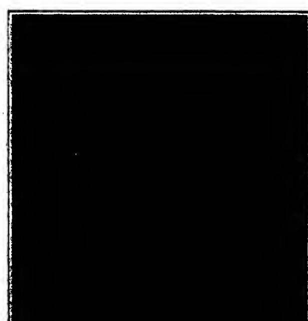
In the intervening half dozen years or so since we made this investigation, several open-hearth plants have been devoted to the manufacture of steel rails; but it cannot be said that this process has given results commensurate with the expectations of that time. Generally speaking, the open-hearth rail is superior to the Bessemer rail; but it is still subject to the troubles arising from segregation and piping, which are present, even when the open-hearth process is used, and still are to be reckoned as the principal causes of the all-too-frequent breakage of rails.

In their order of importance the defects in steel rails are due; first to pipes and blow holes in the ingots; second, to segregation in the ingots; and, third, to too great haste in the rolling of the rails. The first is by far the most serious. When the molten steel is poured into the ingot mold, cooling at once begins to set in, taking place from the bottom and outside inwardly. The shrinkage of the metal causes the surface of the molten metal to sink, the depression increasing until finally there is a deep, roughly conical shaped hole of large diameter at the top of the ingot and decreasing as it descends, this cavity or pipe extending from say a quarter to sometimes more than half the depth of the ingot. When the ingot is reheated and put through the rolls, the cavity or pipe is closed up; but the temperature of the bloom from which the rail is rolled is not sufficiently high to allow the surfaces of the pipe to be welded together, and, consequently, in the worst cases, there will be an incipient line of cleavage or fracture, extending through the center of the rail, which is generally undiscoverable by any surface inspection. Under the hammering of modern heavy traffic, especially in cold weather, this inherent weakness is revealed, particularly at the ends of the rails, which frequently split open, large sections often being broken entirely away.

Segregation is a tendency on the part of the chemical constituents of the molten steel to become concentrated. The effect is most noticeable toward the top of the ingot, and it has the effect of impairing the reliability of the steel. Many devices have been tried during the past few years, with a view to overcoming the above difficulties. The molten steel in the ingots has been compressed hydraulically both from the top and from the bottom;



First ingot, untreated steel; No. 2, 0.036 per cent aluminium added; No. 3, 0.09 aluminium-added; No. 4, 0.09 aluminium and Hadfield top heating, showing absence of piping and segregation.



Pouring the molten steel into a set of ingot molds. Above each is a feeding head, and a bed of slag and blast-heated charcoal delaying solidification of the steel and preventing piping.

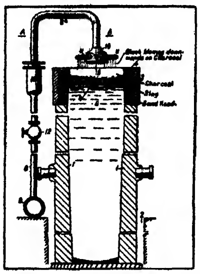
during the settling the metal at the top of the ingot has been kept in the molten state by gas generated heat; ingenious methods have been devised for compressing the steel in the ingots from the sides during cooling. Some of these methods have been illustrated from time to time in the SCIENTIFIC AMERICAN. The objection to most of them has been the heavy cost of the apparatus and the consequent increased cost of the rail.

For some years past Sir Robert Hadfield, the celebrated steel manufacturer, has been carrying on experiments at the Hecla works, Sheffield, directed to the production of perfectly sound steel ingots, and he has met with such success and is so well satisfied with the commercial utility of his methods, that he recently read a paper before the Iron and Steel Institute, which has attracted world-wide attention. The ingots dealt with in that paper are chiefly those of medium size, such as are used for rail production, varying from half a ton to two and one half or three tons each, and from 8 or 10 inches to 20 or 24 inches square.

In a recent letter to the Editor, Sir Robert writes: "Judging from the discussion on my paper, there seems to be some misconception in the minds of many that the system I have described covers only the manufacture of experimental ingots. As a matter of fact, at least 15,000 tons have been made, concerning which I believe a record statement can be made, namely, that to the best of my knowledge and belief, not a single one of the ingots in this large tonnage was imperfect." In the address referred to Sir Robert stated that this method made it possible to secure perfectly sound steel, and to do it both cheaply and efficiently. Moreover, the process not only insures sound steel, but makes it possible to use a much larger percentage of the ingots. In many cases, as much as 92 per cent of the fluid steel in the mold is made utilizable; moreover, this is done at small additional expense.

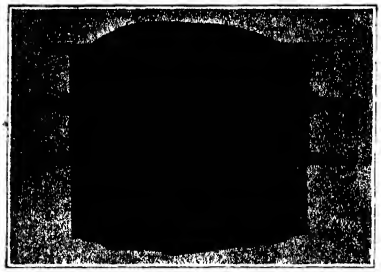
The author of the paper does not deny that large quantities of rails as now made are of excellent quality, but he claims that it is just the "tenth" case which it is important to improve. It is the bad heat here and there, the bad ingots now and then, which gives the fatal rail, involving catastrophe.

Coming now to a description of the process, attention is drawn to the left-hand illustration at the bottom of page 532, which shows a group of four ingots each about four inches square and thirty inches in length, which were made specially to illustrate and test the question of soundness and piping. All of these show the appearance of the ingots after part of them had been cut away. In the first case, steel was poured into the mold just as it came from the furnace, no solidifying addition being made. The second shows the same steel as the first, except that it was "quieted" by the addition of 0.036 per cent of aluminium; it will be seen that this steel is not quite sound. In the third ingot the amount of aluminium was increased to 0.09 per cent. This steel, it will be observed, is perfectly sound, being free from blowholes, etc., but it pipes deeply. So here the steel maker finds himself in a dilemma. If he makes steel that will not settle, it is unsound. If he makes it sound, it pipes. And since the portion with the pipe in it must be cut away and becomes waste, and must be worked over again in subsequent heats, there is a loss of time. The inventor overcame the dilemma by adding the aluminium and also by using an ingenious and simple method for maintaining the upper portion of the ingots in a fluid condition while the lower portion was cooling and solidifying. This was accomplished by using a sinking head and a method of top heating, as described in this paper, the result being shown in ingot No. 4.



This shows arrangement of ingot mold with slag and charcoal bed and air-blast for preventing pipes.

Polished section of a 95-pound steel rail, rolled from ingot prepared by pipeless method.



Enlarged view of sand-head, showing the thin layer of slag and the bed of charcoal above it.

It will be noted that No. 4 is not only free from the blowholes, segregations, etc., of ingots Nos. 1 and 2, but it is also free from the deep pipe which appears in No. 3. The method consists in heating the fluid steel in the upper part of the ingot, and maintaining it in a liquid condition by the combustion in contact with it, or in close proximity to it, during the cooling and shrinking of the metal in the lower part of the mold, of some form of solid fuel, charcoal, for instance. The charcoal is kept in a state of violent incandescence by means of a blast of compressed air, which is caused to impinge directly on the fuel, while this is directly or indirectly supported by the metal below. Between the layer of fuel and the molten metal is interposed a layer of fusible material, such as cupola slag, which has little or no injurious action on the metal. The slag serves to largely prevent radiation of heat, the loss of which, Sir Robert states, is much greater than is usually supposed. Two illustrations near the top of this page show the arrangement of the air blast, fuel, etc., and note will be taken of the molding-box, placed above the ingot mold and lined with a deep layer of sand, which holds the sinking head in which such piping as may occur will take place.

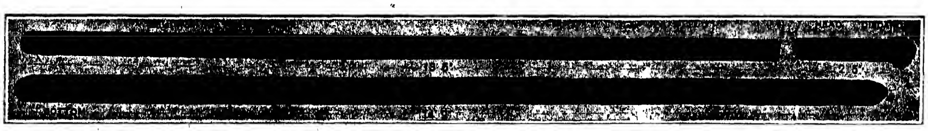
Although the ingots here shown are cast with the small end of the ingot downward, which the author of the paper considers to be the better method, his system can be applied when ingots are cast, as they usually are in America, with the large end downward. For this process, however, he considers that it is better to cast with the small end down, since cooling takes place more quickly, causing the steel to congeal at the lower end and reduce the amount of feeding required later on from the upper portion of the mold.

Compared with the large saving effected by the decreased loss and waste of material, the additional cost of this method is trifling. The quality of the product is improved, and in the case of rail manufacture, not only is there less discard, but the material throughout the whole ingot is sounder. Sir Robert mentions that ingots have been made weighing about five thousand pounds, in each of which the piping and discards did not amount to more than about 7 per cent—a truly remarkable result in ingots of this size. This small loss, moreover, is not the only advantage, the chief one being that the ingot is sound and free from hidden pipes or other defects throughout the whole of its length. On a large output, it is estimated that the saving by this method is from $2 to $3 per ton.

As regards segregation, we are informed that it is almost entirely absent, only a few inches below the sinking head on the top of the ingot being affected. Furthermore, at about four inches below the surface of the sinking head, which is removed before the ingot is rolled in the mills, the percentages of sulphur and phosphorus were practically the same as in the original steel, that is, about 0.03 per cent each.

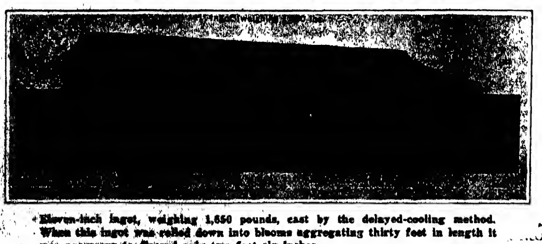
The practical results obtained by this method are shown in the case of two heats which were made of mild steel and two of ordinary steel. In the mild steel the carbon was 0.20 per cent; silicon, 0.40 per cent, and manganese, 0.50 per cent. In the ordinary steel, the carbon was 0.45 per cent; silicon, 0.50 per cent, and manganese, 0.80 per cent. The ingots were prepared in the manner described above. The results obtained are given in Tables I and II. Fourteen ingots

(Concluded on page 543)



Two billets rolled from the 11-inch ingot below. Note the small discard.

Section of above billet 2 feet 4 inches from head, showing no trace of pipe.



Eleven-inch ingot, weighing 1,650 pounds, cast by the delayed-cooling method. When this ingot was rolled down into blooms aggregating thirty feet in length it was necessary to discard only two feet six inches.

Section of above billet 2 feet 5 inches from end, showing last trace of pipe.

Col. Gorgas Receives the Buchanan Medal

IN conformity with ancient custom the Fellows of the Royal Society met on St. Andrew's Day on the occasion of their anniversary for the purpose of electing a new council and to hear the presidential address. At a point in the discourse from the chair the gold medals at the disposal of the society are bestowed upon the respective recipients. Special interest attached this year to these gifts from the fact that the Buchanan medal was awarded for the first time to a distinguished American scientist, viz., Col. William Crawford Gorgas, assistant surgeon-general of the United States Army.

The medal in question was founded in 1894 in honor of Sir George Buchanan, F.R.S., an eminent London physician and sanitary reformer, who died in 1895. It is allotted every five years for notable service in hygienic science or practice, in the direction either of original research or of professional, administrative, or constructive work, without limit of nationality or sex.

The award to Col. Gorgas is made on the ground of his sanitary administration of the works of the Panama Canal. Appointed chief sanitary officer at Havana, Cuba, in 1898, he, there, for the first time, applied the sanitary methods which enabled the American Government to clear yellow fever almost entirely from Havana. In 1903 he was promoted to be colonel assistant surgeon-general by special act of Congress for his yellow fever work in Havana. In 1904 he assumed duty in the Panama Canal Zone. Col. Gorgas has carried out sanitary work in the tropics on a grand scale. He has been called upon, moreover, to lead the way in the prevention of a new class of diseases, namely, those that are carried by insects. In organizing this departure he was obliged to employ new weapons under new organization, requiring fertility of resource and determination in the face of innumerable difficulties. His success at Havana was undoubted; and since his transference to Panama he has still further advanced the technique of tropical sanitation.

The other medallic awards made by the society were as follows: The Copley medal to Prof. Felix Klein of Göttingen, for his researches in mathematics. The Rumford medal to Prof. Heike Kamerlingh Onnes, for his researches at low temperatures. The Davy medal to Prof. Otto Wallach of Göttingen, for his researches in chemistry. The Darwin medal to Mr. Francis Darwin, F.R.S., for his work in conjunction with Charles Darwin, and for his researches in vegetable physiology. The Hughes medal to Mr. William Duddell, F.R.S., for his investigations with technical electricity. His Majesty the King approved the award of a Royal medal to Prof. W. M. Hicks, F.R.S., for his researches in mathematical physics; and a Royal medal to Prof. Grafton Elliot Smith, F.R.S., for his investigations on the comparative anatomy of the brain.

The Motion Picture Film in Court

AN appeal taken from a decree on a bill by the Motion Pictures Patent Company against the Chicago Film Exchange for infringement of patent 589,168, granted to Thomas A. Edison on August 31st, 1897, resulted in a reversal of the decision of the lower court, and in a declaration that Thomas A. Edison was not the pioneer inventor of the moving picture film. In the patent in question, claims 1, 2, 3 and 4 cover the camera and claims 5 and 6 the film. A claim covering the photographic film seems to have been the bone of contention. The Court said:

"The flexible, transparent or translucent tape-like film prepared for taking photographs was not discovered or produced by Edison. It was brought to its present state of perfection by Eastman. . . . He (Edison) provided it with perforations along the edges at regular intervals into which the teeth of ratchet wheels of the camera entered to give it the required motion; a mechanical contrivance to adapt it to the performance of the functions of the machine. This co-operation of the rows of holes with the teeth of moving wheels he had described in a caveat in 1889 as similar to that in the Wheatstone telegraph instrument for insuring positive run of the band. Moreover, perforations had been previously made in photographic films for feeding purposes. .

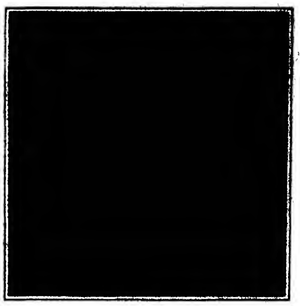
"We do not dissent from the proposition that Mr. Edison solved the problem of the motion picture art with great ingenuity and skill. But the problems that he solved were in the camera apparatus, wherein his true claim to invention lies . . . The long, pliant, translucent, celluloid film with the sensitised surface was the invention and improvement of others. The pictures taken on such a film are photographs. It is the particular character and arrangement of those pictures for which Mr. Edison is entitled to credit. But those pictures and their arrangement are nothing more than the result of the operation of his improved camera apparatus. The problem that was solved by their production and arrangement was a problem of the camera machinery. . . .

"The invention of Edison was exhausted in the construction of the camera which enabled the photographs of moving objects to be taken upon the Eastman film in the distinct, uniform and satisfactory manner [illegible] claimed for them. The pictures taken are the direct result of the mechanism of the camera with the Eastman film mechanically adapted to and applied thereto."

The Submarine Sledge

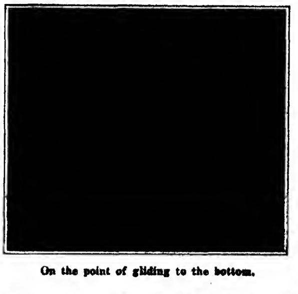
By the Berlin Correspondent of the Scientific American

THE diver's art has been known ever since the remotest antiquity, and even with primitive peoples there are men enabled by their personal skill and long practice to remain below the surface of the sea for a relatively long time and to bring up objects from the shallow ground. But only in quite recent times has this art made any real progress by the invention of special divers' suits, affording airtight protection from the water, and supplying the man, through a length of



The diver and his sledge.

hose communicating with the surface, with the air required for breathing. Being thus in a position to remain below the water for a considerable length of time, fully protected by safety devices, divers have in recent times rendered most valuable services to engineering and navigation, e. g., in connection with submarine building and ship repairs. Apparatus has also been invented which makes the diver practically inde-



On the point of gliding to the bottom.

pendent of the outside world; containing as it does everything required for the regeneration of the air breathed out by the man, this outfit allows of several hours' work below water.

The latest advance in this direction, however, is the submarine sledge, designed and constructed by the inventors of the self-contained diving outfit described in our issue of October 5th, 1912. This is a sledge towed by a motor boat, and on which the diver glides comfortably to and fro at the bottom of the sea, steering his vehicle vertically as well as laterally.

The submarine sledge, which greatly increases the capacities of divers, is intended to convey the man rapidly from one place to another, e. g., in searching for lost torpedoes, discovering and securing submarine mines, or handling torpedo batteries. However, its use in ascertaining the position of foundered vessels is quite as important; divers equipped with the most recent diving outfit are, on this sledge, in a position to reconnoiter most rapidly a considerable submarine region at depths down to 130 feet.

The diver, having seated himself on the sledge on board the accompanying vessel or motor boat, is lowered to the depth of the sea on a slide or by means of a davit. On two lengthy sledge runners bent up in front and connected by a curved bow are placed the [illegible] elevation rudder and at the rear [illegible] lateral rudders, all of which are operated through a lever gear from the diver's seat. As long as the tanks are filled with compressed air, the sledge with the diver floats on the surface of the water. All that is required for diving down to the bottom is to discharge some air from the tanks, admitting water into them or else to depress the elevation rudder, when the sledge will glide to the bottom without any violent shock. In order to return to the surface, the diver has only to raise the elevation rudder or to force the water out of the tanks with compressed air. During his course he may dive up and down at will by actuating the elevation rudder, and only on going down to or leaving great depths must he necessarily use up some compressed air. The air regenerating apparatus strapped to the diver's back contains a telephone set and is connected by a long flexible cable with a reel on the towing boat at the surface, making it possible for the diver to be in constant communication with his assistants above or those in charge of the work.

The duration of this submarine journey is dependent on the working of the air regenerator in the diving suit. The capacity of the potash cartridge, for absorbing the carbonic air breathed out by the diver, will be exhausted after about three hours, when the diver must return to the surface for a fresh potash cartridge.

The diver need have no fear of the pressure of water currents even in the case of a high speed of traveling. The protective shell behind the seat, in fact, keeps him in quiet water, the spiral water currents set up by his motion coming out behind the shell. In full daylight, no artificial lighting is required for exploring depths of about 130 feet. In order, however, to work in the dark, the diver should carry submarine lamps unless the sledge be provided with a searchlight fed with current from the motor boat. The diving equipment affords an effectual protection against accidents. The inertia of the water, by the way, makes itself felt in a striking manner on a submarine journey; the shock on the rocks or against other obstacles is damped most effectually, the strange vehicle moving in its medium with the same swiftness and docility as an aeroplane. In fact, the advent of a new sport, that of submarine travel, may be foreseen for the near future. The total weight of the apparatus without telephone is 420 pounds, and 530 pounds with the telephone transmitter, receiver and auxiliary apparatus. This equipment was utilized recently by a diver to descend to about 70 feet below the surface to inspect the intake of the electric power plant of the city of Lubeck, Germany.

Panama Pacific Exposition

IN an address delivered before the New York Electrical Society by John A. Britton, some interesting information was given on the Panama Pacific Exposition. The development of the Exposition has progressed so far, Mr. Britton said, that the work is eight months ahead of schedule time.

The first building, the Administration Building, is almost complete. The foundation has been laid for the Machinery Hall, a structure over 900 feet long and 320 feet wide. Approximately 600 acres of land over the bay shore have been filled in. About 1,500 houses that covered the site have been bought, besides a number of manufactories. The streets of the Exposition have been laid out. Already some 60,000 trees and shrubs have been planted. Soon 40,000 more will be set out.

Thus far $16,000,000 has been raised, to which some $6,000,000 was contributed by the public of San Francisco, $5,000,000 given by the State and $5,000,000 by the City. When the doors of the Exposition are opened there will be no debts.

The area covered by the Exposition will be 1,100 acres. On both sides, east and west, it will be flanked by the Government Reservation, to the extreme west by the Presidio, one of the most beautiful reservations of the Government located anywhere. A strip of land along the shore of San Francisco has been given to the Exposition and a boulevard will be built from the Exposition through the Presidio grounds to Golden Gate Park on the extreme western end of San Francisco. On the east the Exposition is flanked by Fort Mason, another Government Reservation, and by the docks recently built by the Government at a very great expense.

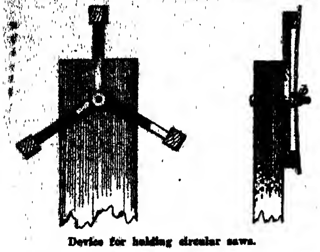
Purifying the Air in Rooms

TO purify the air of offices or sick rooms soak a few pieces of brown paper in a solution of saltpeter and allow them to dry. When desired for use, lay a handful of flowers of lavender, which can be got at any drug store, on a tin pan with a few pieces of the paper and light. The aroma is refreshing and [illegible] drives away insects. If hot water is [illegible] a few drops of oil of lavender in a glass of very hot water is used. It purifies the air [illegible]

Holding Circular Saws While Sharpening

By William [illegible]

THE ordinary vise or bench clamp is about the only means in the shop that the workmen know of, to hold circular saws while being sharpened. The average workman knows how difficult it is to sharpen such a saw, as the vise or clamp does not hold it firmly



Device for holding circular saws.

enough. The following method will hold the saw securely, and allow good sharpening to be done: Upon some post or leg of a bench, three arms, each about 12 inches long, are bolted. On the end of each arm, a small block is placed, as illustrated in the side view. A hole is bored through the post and the center of the arms, to allow a long bolt to be inserted. To hold the saw, place it upon the arms, and put the bolt and nut b in place. When tightening the nut b the saw will be drawn firmly against the blocks on the three arms. When filing the saw, it will not slip back or forth, as it would in the other clamps.

Some Workshop Suggestions

By B. F. Dashiell

THE following are a few workshop "kinks" that have proved helpful to the writer, who hopes they may prove equally helpful to others:

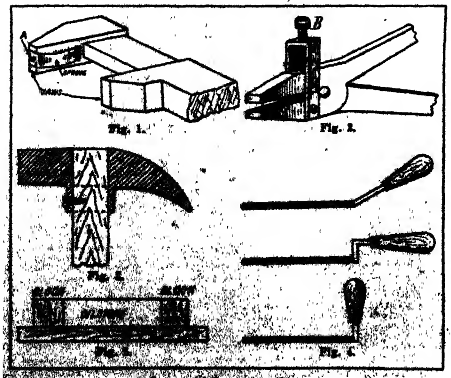
Device for Holding Nuts in a Monkey Wrench.—It is quite an advantage sometimes to be able to hold a nut in an ordinary monkey wrench, when it is to be applied to or removed from the bolt. An ordinary wrench may readily be adapted to hold a nut if one of the jaws be provided with a piece of spring sheet metal as illustrated. (Fig. 1.) This spring is preferably applied to the stationary jaw, to which it is secured by a screw. The jaw has to be drilled and tapped to receive the screw A which holds the spring. A slight curve is given to the spring so that it will hold the nut firmly in the jaw.

Vise Pliers.—A pair of pliers is virtually a hand vise without any means for holding the jaws in fixed position. There are some pliers, however, on the market which are provided with such a holding device and these pliers are known as vise pliers. It is a simple matter to provide such an attachment for any pair of pliers. Fig. 2 shows how this may be done. A piece of heavy strap metal A is bent to a U form and is fastened to one of the jaws of the pliers with a pair of small machine screws. A set-screw is threaded through the strap as indicated at B in the drawing. When this screw or bolt is tightened upon the jaws it holds the pliers firmly upon the work, leaving the hands free for other duties. If this holding device is applied to a pair of pliers of the parallel jaw type, the vise pliers may then be used as a wrench as well as a vise.

Fastening Hammer Heads on Handles.—The heads of hammers and hatchets have a strong tendency to become loose and work off the handle after a time. Not only is this annoying, but it is positively dangerous. A simple method of overcoming the danger is to drill a small hole transversely through the side of the hammer or hatchet to admit a small screw. The head may then be fastened to the handle by means of this screw as shown in Fig. 3.

Files for Large Surfaces.—When filing a large and flat surface, the file handle has to be raised above the plane of the work. This can be readily done by annealing and bending the handle up. The drawing (Fig. 4) shows various form of files thus bent. With such files it is then easy to go over the whole of the work and use the entire file, without having the handle in the way.

Keeping Oilstones True.—Oilstones soon become hollow in the middle due to the fact that the ends cannot be used. If two blocks of wood are glued to a base on each end of the stone the whole of it can be used, as the tools slide out on the wooden blocks. The drawing (Fig. 5), published herewith, illustrates the arrangement.



Some workshop suggestions.

Why a Plane "Iron" Has a "Cap"

By W. D. Graves

MORE completely than almost anything else are the tools of mechanics free from all superfluous parts, and there is rarely even a variation of their outline but that has material effect on their usefulness, though that effect is not always immediately apparent. The tacks driven by a cobbler do not differ much from those driven by an upholsterer; yet there is good reason for the very wide difference in their hammers, as there is also for the difference in the mauls used by the ship caulker and the stone cutter. While it may be instructive to study the reasons for these differences, even though one does not expect to "clout shoon" nor caulk ships, it is better, first, to be sure that one fully understands the significance and value of all the parts of such tools as all of us are apt to find use for. With such knowledge of the common plane, for instance, we may be able to accomplish work which would otherwise be wholly beyond us.

The thing about a plane the reason for which seems least understood is that—except in a few special forms—the cutting member is made in two parts; the "iron" proper, which does the actual cutting, and the "cap" which is slidably bolted to it. This "cap" is absolutely essential to the accomplishment of the best work with a plane; yet even some joiners do not fully understand its application. Its office is to break the fiber of the shaving, holding it down meanwhile, so that it shall be severed from the wood directly by the cutting edge rather than be torn away by a wedge-like lifting action.

To illustrate roughly let us suppose that we wish to remove, with a jackknife, a thin sliver from the top of the piece of wood W, in Fig. 1, in which the grain runs in the relative direction indicated by the broken lines. When practicable, of course, we would begin the cut at the right, cutting "with the grain;" but in the supposition case we will begin at the left. If we were to press the knife blade directly in from the point A, the split would run a little ahead of the knife edge and follow the grain to F. If, however, we press the blade in a little at a, then tilt it sharply upward, a short piece is broken off. If we now press the blade in a little at b, c, d, etc., breaking off a piece each time, we will eventually have roughly removed a thin layer from A to B. This is essentially what is done by the plane iron and its cap, except that the shaving, being thin, is not broken entirely apart, and being thrust downward when it is broken, it is not *pulled* away from the wood, but is first severed therefrom by the sharp cutting edge, then thrust away.

The diagram, Fig. 2, illustrates how the shaving, immediately after the cutting edge lifts it, is thrown sharply forward and broken, at the same time being pressed downward, by impinging on the end of the cap. In working hard and cross grained woods the cap is placed very close to the cutting edge, so that the breaks in the fibers of the shaving are very close together indeed. As this necessitates the taking of a correspondingly thin shaving and makes the plane push much harder, it is customary to set the cap farther back in planing softer woods with the grain, or in cases where smoothness is not specially desired. It is essential to good results that the tip of the cap be fitted very snugly against the front of the iron in order that the shavings may not crowd under it.

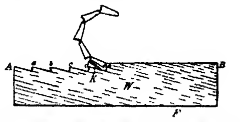


Fig. 1.—Planing against the grain without a cap.

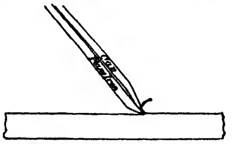


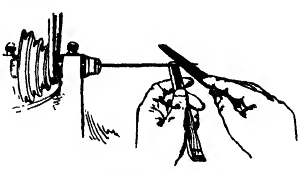
Fig. 2.—How the cap breaks the shaving.

Steady Rests for Small Lathes

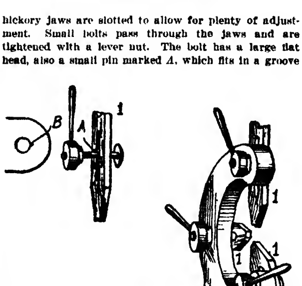
By Albert F. Bishop

WHEN the jeweler wishes to reduce a slender wire in the lathe by filing he simply holds a piece of hardwood with a small notch in it under the wire. This will steady the wire so he can file it down quite rapidly. Jewelers prefer boxwood.

A simple form of steady rest is shown in one of the accompanying drawings. In making this rest it is necessary to construct the body of cast iron. The jaws marked 1 are made of hickory. Do not use fiber. The hickory jaws are slotted to allow for plenty of adjustment. Small bolts pass through the jaws and are tightened with a lever nut. The bolt has a large flat head, also a small pin marked A, which fits in a groove in the steady rest marked B. This groove is easily filed in. The lever nuts should be adjusted so that when they are tightened the levers will stand away from the center. This gives plenty of leeway in setting the jaws on the work.



The jeweler's steady rest.



Simple steady rest for small lathes.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Machine That Washes Fourteen Thousand Dishes in an Hour

By Jacques Boyer

WITH the aid of Hamet's automatic dish-washing machine, which has been in operation for some little time in the kitchens of the Samaritaine home, in Paris, one man can rinse, sterilize and dry 14,000 plates in an hour. The machine is made of forged and drawn steel, and is very strong and simple in construction.

Its principal feature is a rotating drum composed of two hexagonal frames connected by six cylindrical rods, from which are suspended six pans loaded with dishes piled in tinned-iron racks. The trunnions of the drum turn in bearings which are mounted on opposite sides of a trough 55 inches long, 31 inches wide and 22 inches deep, containing water which is heated to the boiling point by coke, gas or steam. The height of the machine is 37 inches.

At the Samaritaine the work is expedited by assigning to the machine a number of men who wash the plates roughly by hand and pile them directly in the racks which are turned on end for this purpose, so that the plates stand on edge when the racks are again set on their bases.

The operator of the machine puts one or two racks of plates on the nearest pan, and, by pressing downward on the bar, turns the drum through one sixth of a revolution. In this way the loaded pan is lowered into the hot water and the next pan is brought into position for loading.

When all six pans have been loaded by repeating this operation, the first pan is again in the loading position, and the plates carried by it have been thoroughly rinsed and sterilized by their passage through the boiling water, and dried by exposure to the air during the remainder of the revolution. The racks containing these plates are then removed from the pan and replaced by racks of partly washed plates, and so the operation goes on indefinitely. It is not necessary to balance the pans carefully, as the motion is controlled by a brake, which also prevents the drum from turning backward when the finished plates are removed from the pan.

It takes about 10 seconds to unload and reload a pan, and there are always two pans in the water, so that each plate is immersed 20 seconds. When two racks of 20 plates are placed on each pan, therefore, the machine turns out 40 plates every 10 seconds, 240 every minute or 14,400 per hour.

The operation of the machine requires very little effort, as the ascending and descending pans are nearly balanced. The dishes come from the machine absolutely dry and glossy, as the writer can testify from personal observation. Hence it appears probable that many hotels, restaurants, hospitals, schools, etc., will adopt this simple apparatus, which effects a great saving in labor.

For use in smaller establishments Mr. Hamet has constructed a smaller machine based on the same principle. This apparatus has only one pan which is suspended from a double scale-beam and balanced by a counterpoise. The beam turns in bearings mounted on the sides of a trough filled with boiling water. The apparatus is so constructed that the pan, whether heavily loaded or empty, remains in stable equilibrium in the loading position and also when immersed. The machine is operated by one man who roughly washes the dishes by hand and deposits them in racks. When he has filled two racks, he places them on the pan and lowers them into the water, where they remain until he has filled another pair of racks with roughly washed dishes. He then raises the pan by tipping the beam and substitutes the second pair of racks for the first pair. The rinsed dishes dry in a few seconds. With this little apparatus 2,400 plates can be rinsed in an hour, with an immersion of one minute, and the number can be increased by shortening the immersion.

Fourteen thousand dishes rinsed, sterilized and dried in an hour.

Twelve Thousand Postage Stamps Per Minute

By Thomas D. Gannaway

TO print, gum, dry, perforate, and either cut into sheets or wind into coils twelve thousand postage stamps in one minute, seems an impossible feat to even an experienced man. But a new departure in the art of plate printing is being made in the Bureau of Engraving and Printing; a change which has been sought for many years with disappointing results by practically every civilized nation in the world. The seemingly impossible feat remained unaccomplished until the completion of a machine, which was designed and built by Mr. Benjamin R. Stickney, Mechanical Expert and Designer of the Bureau, under the direction of Mr. Joseph E. Ralph, Director of the Bureau of Engraving and Printing. Heretofore it was necessary to wet the paper and allow it to become mellow before putting it through the press; but now it is printed dry.

Every one probably knows that the ordinary newspaper and book printing is done on raised type, while plate printing is just the reverse. The plate after being inked must have its surface wiped off clean; then the ink for the impression must be lifted by the paper out of the many fine depressions in the plate.

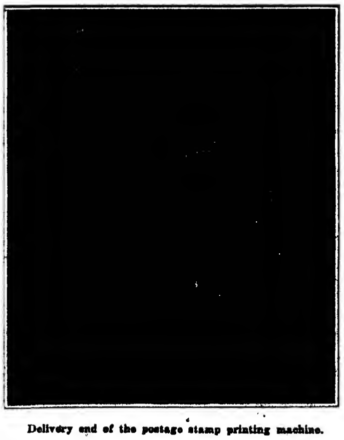
Moistening the paper renders it soft so that with a moderate pressure in the press it may be forced into the depressions in the plate and thus pick up the required amount of ink to make a perfect impression. It requires a tremendous pressure to accomplish the same results on dry paper; a pressure that cannot be obtained on an ordinary plate printing press. In the old process, as the paper has to be wet and allowed to mellow, the printing cannot be done on a continuous roll, but sheets have to be used.

Until two years ago, when Mr. Stickney invented a machine for wetting paper on which money was to be printed, all paper for plate printing had to be wet by hand. A wet rag is placed between every twenty sheets of paper, and they are then put under slight pressure in stacks of 1,000 sheets and allowed to remain over night. To distribute the moisture more evenly these bunches of twenty have to be taken out and split in the middle, turning the wet sides together, and then re-stacked with a new set of wet rags and allowed to remain under slight pressure for another night, after which the rags must be removed.

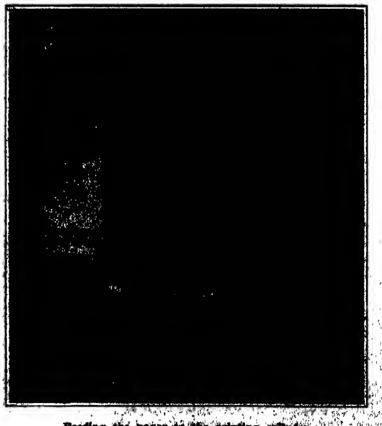
Mr. Stickney's new invention does away with all this labor, as it prints from a continuous roll of dry paper. There being no sheets to handle as the process of manufacture is going on, there, consequently, is no necessity for the many counts of sheets as in the old method.

The new machine eliminates nineteen operations in the manufacture of postage stamps and will work a saving of about 57 per cent of the present cost of them.

The process is as follows: The roll of paper is placed in a holder which stands off a few feet from the machine and then passes overhead to the top of the press, then down between the feed roller and the printing cylinder. This feed roller is so arranged, that by turning a small wheel, a tremendous pressure can be put on the top of the printing cylinder where the paper passes over it, thus enabling the printing to be done on dry paper. Just back of, and half way up the side of the printing cylinder is the inking fount. At the bottom of the [illegible]



Delivery end of the postage stamp printing machine.



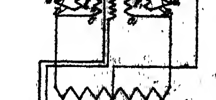
Feeding the paper to the printing cylinder.

[illegible] are a number of metal fingers, a flexible arrangement, which covers a space about eight inches wide and the full length of the cylinder. They are so constructed that they vibrate back and forth lengthwise of the cylinder. Passing over this is a wiping belt which vibrates with the metal fingers at high speed and at the same time moves slowly forward, thus carrying away the ink as it is wiped off and at the same time insuring a clean portion of the cloth to polish the engravings on the cylinder as the ink is wiped off. This is accomplished by having the wiping cloth move slowly from the front of the cylinder toward the inking fount. As the engraving leaves the point of contact with the wiper, it is evenly wiped and polished as nicely as if it were done by hand. The paper passes from the printing cylinder to the top of the machine again, and through a group of ten electrically heated cylinders where the ink is dried. From here it passes to the gumming fount, where it is automatically gummed, and passes from there into the steam-heated drying shaft, which is about twenty-five feet long. This shaft has a series of rollers and belts in it which carry the stamps through to the perforator. As they pass through this shaft the gum is dried, and by the time they reach the perforator, they have dried sufficiently to permit of packing. They enter the perforator from the drying shaft and then the slitter and coiler, where they are cut into ten strips of the width of one stamp and coiled into coils of the desired size. This portion of the machine may be changed so that it will cut the roll of stamps into sheets instead of slitting and coiling it.

The manufacturing of our postage stamps is a much larger task than the average person has ever dreamed of. It takes about forty millions of postage stamps (of all denominations) per day to supply the American people. Is it any wonder that efforts were made to devise some more rapid means of printing them? In the course of a few years' time the new machine will have saved the Government several millions of dollars on the cost of postage stamps alone. The passage of the postal savings and parcels post acts has greatly increased the demand for stamps. Of course, this increased demand can be more easily met by use of the new machines than would have been possible under the old method. The introduction of a few reforms like this will certainly make penny letter postage possible.

A Network Protector

In the distribution of alternating current for light and power in congested communities, it is the common practice to group the customers, extending the low voltage or secondary distributing main over a considerable area, installing transformers of large units at convenient points, and interconnecting them on both the primary and secondary sides. While this system has



A network protector.

the advantage of improving the voltage regulation, it also possesses the disadvantage that in case one transformer burns out, causing a short circuit on the system, the primary fuse of the defective transformer is at once blown, dropping the unit from the line, which the remaining transformers are called upon to pick up. Also the transformer will draw a short circuit current from the secondary line, which further increases the load on the remaining transformers. The nearest transformer will take up most of the load, causing its fuse to blow which in turn will cause the fuse of the next one to burn out, and so on through the entire system. To overcome this defect, an inventor has devised the protector shown in the accompanying diagram. At A is a commercial transformer, one terminal of the primary being connected in series with a coil B of a current transformer. The terminals of the secondary of the commercial transformer are each connected through its own coil C and C_1 on the current transformer. These latter coils connect to the middle point of the looped fuses D and D_1. One side of the fuses connect from E and E_1 to the outer conductors of the 3-wire network. The fuses D and D_1 act as a short circuit connection on coils F and F_1. The function of this combination is that under normal conditions, the currents in the primary B and the secondary coils C and C_1 having the same ampere turns and connected in opposition will neutralize each other so that there will be no m. m. f. circulating in the core of the current transformers to energize the coils E and E_1. This balance of conditions is maintained at all loads and is only upset by a reverse current flowing from the secondary network into the transformer, as is occasioned by a short circuit in the latter. This condition immediately reverses the relative polarity of the coils C and C_1, thus energizing the core and causing a heavy short circuit current to flow through the coils E and E_1 by way of their short circuiting fuses D and D_1. The heavy short circuit current through the fuses immediately ruptures them and isolates the main terminals at G and G_1. A supply of current sufficient to blow the V fuse is obtained with a reverse current in the secondary of about one quarter full load current on the transformer. The defective transformer will thus be instantaneously cut out and disconnected from the line, allowing the remaining transformers connected to the network to continue their function, taking up the load of the defective transformer with no resulting interruption in the service.

Simplified High-potential Apparatus

By Our Berlin Correspondent

The writer a short time ago had the good fortune to see a most interesting and useful apparatus developed by William Dubilier on a recent trip to the Continent, where his radio-telephonic system is to be adopted by the governments of several countries.

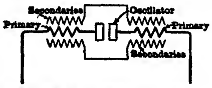
This apparatus purports to place the use of electric waves for X-ray treatment and photography, and for other medical purposes, within the reach of everybody. It is free from any heavy and complicated devices, so that it requires but one operator and may be worked by a layman as well as by an expert.

The apparatus is based on Dubilier's method of producing undamped oscillations with an uneven amplitude as used in his wireless telephone. It is contained in a box of 1[illegible] × 9 × 8 inches and comprises two transformers, a quenched-arc oscillator and a small condenser. Though only weighing 15 pounds, it allows a heavy discharge of over 6 inches to be obtained.

Each of the transformers, which are designed on entirely new principles, contains two secondaries with a primary coil between them, which are so constructed as to produce very little magnetical leakage. The core traverses the center of these coils, and these are so wound and arranged as to obtain resonance. A small variable quencher or oscillator is used as an interrupter which is so designed that its resistance always varies so as to obtain a large transformation of energy. This oscillator is so connected with the primaries that the inductance of these coils with variable currents is less than in the case of one continuous coil. The current is regulated by means of a small screw which changes the mean length of the oscillator.

With a primary current of 2 amperes and 110 volts—either direct or alternating—the discharge obtained from the secondary is sufficient to operate large X-ray tubes for photography.

The problem of insulation is solved by using a vacuum drying and impregnating apparatus with a layer of solid, pure insu-



Simplified high-potential apparatus.

lating material between each two layers of the secondary. The machine is of remarkably low weight, and therefore can be readily carried to a bedside.

The Maxim Motorboat Silencer

Much space has been given in the newspapers to the silencer for motorboats invented by Mr. Hiram Percy Maxim. Inasmuch as foreign patents are pending, it is impossible for us at the present writing to give a detailed description of the invention. However, Mr. Maxim informs us that the silencer is entirely different from any of the so-called mufflers in common use on motorboats. Mufflers accomplish only a diminishing of the sharpness of the exhaust and do not really silence it, he claims. They accomplish the former by providing an expansion space and a tortuous outlet passage. Their effect is only that resulting from slowing down the velocity of the gas as it issues into the atmosphere.

Mr. Maxim states that the noise of the exhaust of a two-cycle engine consists of two separate noises—a fact generally unknown up to this time. One of these noises, called by him "the primary noise," is originated close up to the exhaust port of the engine, where the gases issue at an extremely high velocity. Whenever any object passes through the air at a velocity in excess of the velocity of sound a sharp "crack" noise is developed. This was first made apparent when the Maxim silencer was used on firearms. Although the silencer would entirely eliminate the report produced at the muzzle of the gun by the powder gases, there was a noise heard out in the air beyond the gun, whenever the bullet velocity exceeded the velocity of sound. The exhaust gases from a gas engine, when they discharge, have a velocity considerably in excess of the velocity of sound and, therefore, originate a "crack" noise. This noise, having once been started, advances at the normal velocity of sound and travels on through the ordinary muffler, and, issuing at the discharge pipe, makes the sharp sound we hear when a motorboat passes. The ordinary muffler is powerless to annul this noise. In the Maxim silencer this noise is "trapped" and entirely dissipated before reaching the outlet. The result is an approximately silent exhaust.

We are informed that very interesting tests have been conducted with the new silencer on engines attached to a dynamometer to determine its effect upon horse-power output. On a dynamometer, we are told, there is absolutely no loss of power indicated. Water is injected into the silencer from the water circulation, and this keeps the silencer always cool. The silencer can be used without water if desired.

Tests conducted on a boat in the Connecticut River are of particular interest. The method of test consisted in starting a boat from a landing stage with instructions to the pilot to keep going straight away until a flag waved by the observer on the landing stage indicated that the sound of the exhaust could no longer be heard, whereupon the boat was to return and report the distance traveled by log. It was found with the best of several mufflers on the market that the boat was able to proceed roughly one mile before the sound of the exhaust was entirely lost. The same boat then had its muffler removed and the Maxim silencer substituted, Mr. Maxim claims, and was started off again. At a distance of approximately 100 feet the sound of the exhaust was entirely lost.

The diameter of the new silencer for all engines up to 25 horse-power is 6¾ inches. For engines up to 4 horse-power the length is 14 inches. For engines up to 8 horse-power the length is 17 inches. For engines up to 15 horse-power the length is 25 inches. An idea of the weight of the device can be obtained from the statement that the 17-inch long silencer weighs 24 pounds.

In the construction of the silencer there are no holes or small passages to clog. In their passage through the silencer, the exhaust gases add themselves to gas traveling in the same direction, and this is the principal reason for the absence of back pressure.

Notes for Inventors

Expansion Chamber for Pneumatic Tires.—Automobile tires frequently burst or blow out because the pressure of the air rises above the limit of safety owing to the heat generated by the friction of rapid travel or sudden contact with an obstacle in the road. In the ordinary tire there is no provision for taking up the excess pressure due to variation in temperature in the confined air, and this is liable to produce injurious strains in the tire which greatly shorten its life. Recently an inventor has patented an improvement, No. 1,035,207, which consists in providing a reservoir at the hub of the wheel that communicates with the tire. This reservoir is made of elastic material which is kept under pressure by a spring-pressed plate. The pressure of the springs is sufficient or equal to the pressure of the air in the tire. Any excess of pressure in the tire results merely in compressing the springs. In this way bursting pressures are compensated and the danger of shocks and blows is avoided.

Changes in the Patent Office Force.—Principal Examiner C. C. Stauffer, for many years in charge of Division 15, has resigned from the Patent Office. Principal Examiner G. P. Tucker has been transferred from Division 35 to Division 15, Mr. Stauffer's old division, and Principal Examiner A. D. Merritt has been transferred from Division 40 to Division 35. The resignation opened the way for the appointment of a new principal examiner, Mr Herbert Lewis, who has been assigned to and taken charge of Division 40 in which he has long been the ranking assistant. Mr Lewis is a native of Haverhill, Mass., a graduate of Amherst College, class of 1891, and Massachusetts Institute of Technology, 1893, and prior to entering the Patent Office had experience with the Westinghouse Electric Company in Pittsburg and in Boston as electrical engineer. Entering the Patent Office in 1894 as an assistant examiner, he served in Divisions 8 and 11 until promoted to first assistant in 1907, when he was assigned to Division 40 and has continuously served in such division until promoted to principal examiner. Mr Lewis, therefore, has a special advantage in being schooled and experienced in the class in his charge.

A Shaving Brush That Cannot Fall Over.—In design patent No. 43,250, David H. Watts of Olden, Pa., shows a shaving brush, the handle of which has at its end opposite the brush proper a flattened surface on one side in a plane diagonal to the axis of the handle so that the brush can be supported at an incline with the brush proper elevated off the table, washstand or other surface upon which the brush may be rested.

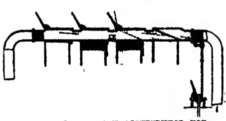
How to Mend a Moving-picture Film.—In patent No. 1,044,258, Edward J. Schafer of Seaside, Ore., shows a film-repairing machine in which clamps are provided for retaining the film on a table and pressers hold the film down on the table on opposite sides of the break, the table being transparent, and means being provided for illuminating the table and film, thus aiding in the repairing operation.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN

Of Interest to Farmers.

AUTOMATIC SUCTION DISTRIBUTER FOR GINNING PLANTS.—B. RAND, Box 62, Mansville, Okla. The invention provides a suction pipe having a pair of passageways. Each of these is adapted to have a plurality of openings in the bottom through which the cotton is discharged. A baffling screen is ad-



AUTOMATIC SUCTION DISTRIBUTOR FOR GINNING PLANTS.

jacent each opening and is movably mounted so that the same may be moved into the path of movement of the cotton for directing it to any opening. A movable floor is provided for each opening for preventing entrance of cotton under certain circumstances. The openings are in pairs and open into chutes which merge into a single discharge pipe, to which is connected a gin whereby when cotton is fed to either of a single pair of openings the gin is receiving cotton. A longitudinal vertical section through the invention is shown in the engraving.

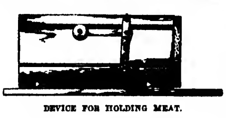
PLANT SETTING DEVICE.—H. R. GLOSSOP, Friday Harbor, Wash. This device has a rotatable member with clamps for holding plants, the clamps being opened by a trip when the plants carried by the clamps are disposed in a furrow in the rear of a furrow opener. Press wheels are secured to the device for filling the furrow after the plants have been disposed in position and a water nozzle is opened periodically to supply each plant with water as the device is moved along the ground.

HAY PRESS.—E. L. WETZIG, Clint, Tex. The inventor provides means in a press for reciprocating the plunger at regular intervals, and wherein the connection between the operating means and the plunger is of a character to transmit a high proportion of the power of the motor with a long working stroke and a quick return.

EVENER.—WILLIAM C. HOPPES, Dawson, Neb. The principle advantage possessed by this evener is that when attached to a plow the draft animal walking in the furrow has his trace chain connected at a lower level than the other animals, so that he will have as straight and direct a pull as they. The device consists of two bars, one six inches above the other, with a link connection at one end. To this link at any desired adjustment vertically thereon a double-tree is connected while the opposite ends of the bars each are provided with swingle-trees. The two bars are so connected that the pull of each animal exactly balances the pull of all the rest.

Of General Interest.

DEVICE FOR HOLDING MEAT.—F. BRIGGS, 45 Bryant St., N. W., Washington, D. C. This device for holding meat is shown in the engraving in a side elevation, and is especially adapted for that class of meat or hams which are cooked and compressed in cylindrical cooking vessels, and is adjustable



DEVICE FOR HOLDING MEAT.

to rolls of different sizes. Both ends of the receptacles are preferably open, so that after the roll of meat is clamped therein it may be pushed out at either end for the purpose of cutting off slices, and in this operation the end of the receptacle will form a guide for the knife so that the slices will be cut evenly.

RACK.—O. LYNNE, 226 Helmen Bldg., New Orleans, La. This invention relates to racks to hang or hook onto a radiator and to operate as a combination drying rack, foot rest and book shelf. The device is portable and adjustable to be attached to and detached from steam, hot-water, gas and electric radiators to allow principally of a convenient and comfortable warming of the feet without burning the shoes or feet. It may also serve as a chair for warming the back.

FLUME CONSTRUCTION.—J. H. MARTIN, National Hotel, Joliet, Ill. The intention here is to provide a device adapted for use with current motors in Mr. Martin's co-pending application Nov. 22d, 1911, of which the present case is a division, wherein a support is provided for the motor, and in addition means for concentrating the current on the vanes of the motor, and wherein means is provided for cutting off the current partly or entirely from the motor, and for fending drift or the like that might strike or injure the motor.

HYDRANT.—T. H. BARKER, 822 9th Ave., Durango, Colo. This device has a [illegible] valve at the inlet, and a removable seat co-operating with the valve and means for equalising pressure on the valve, and having a peculiar character of port in the valve to insure maximum flow of water with minimum amount of rotation, together with means for limiting rotation of valve to a quarter turn, and for pressing the valve into the seat to compensate for wear.

LADDER.—W. F. MCGRAY, care of W. O. McAllister, 45 Bridge St., Moncton, New Brunswick, Canada. This improvement relates more particularly to a wire ladder made up of a number of similar units, the construction and arrangement, however, being such that a rigid article is produced. It is made up of a number of similar links rigidly connected together whereby the ladder may be picked up from a horizontal position into a vertical one without coming into folded position.

SHAVING BRUSH.—M. W. KENADY, 1285 Taggart St., Portland, Ore. This brush has a hollow handle, forming a reservoir, which is slidably mounted in a tubular member, to which the brush is secured, so that valve mechanism connected with the handle and the tubular member will be operated when the handle is moved relatively to the tubular member to permit the liquid soap contained in the fountain to flow to the brush.

INHALER.—G. A. EVANS, 909 Bedford Ave., Brooklyn, N. Y. This invention relates to a vaporizing inhaler, and more particularly to one designed for the treatment of diseases of the nose, throat and lungs. It regulates the amount of air fed through the same and provides means for regulating the medicinal strength of the impregnated air. It provides an outlet tube for a device having means for regulating the expiration of air from the lungs.

TURPENTINE APRON.—W. O. DALY and L. LESIO, 69 Anthoney St., Mobile, Ala. The two sections of the apron are fitted together edge to edge when applied for use. The anchor section is a narrow strip of metal with a saw tooth edge which is driven into the tree, which facilitates the application of the apron, and forms a secure support for the other or body section which is fitted to the outer edge of the anchor section. When the apron is used on a tree which has been faced off the anchor section may be employed, while on a curved tree, after a straight section has been started into a tree, it may be tapped on its outer edge to bring it into curved form to conform to the curved tree.

METHOD OF AND MEANS FOR PROTECTING THE BORES OF HEAVY GUNS FROM EROSION.—F. N. DU BOIS, Catskill, N. Y. The aim of this invention is to obviate the defect of erosion by a method of and means for applying a coating of metal under pressure to the eroded portions of the walls of the bore at or after each discharge of the gun, whereby a fresh metallic surface is presented thereby to the action of gases and heat.

Heating and Lighting.

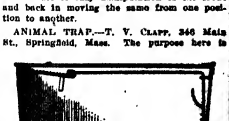
STOVE.—W. F. PINKERTON, Millbrook, Wyo. This fire-cage is especially for use in burning straw, weeds, cornstalks, chaff, grain, screenings, dust, waste paper and other trash and refuse. The invention is an improvement upon Mr. Pinkerton's former patent No. 955,058, and provides a stove better adapted for burning fuels in a green or wet condition and also for burning the particular kinds of fuel before specified.

BLOWPIPE TORCH.—A. J. EDDY, 865 Chelsea Ave., Long Branch, N. J. The invention provides means for preventing the boiling over of fluid liquid, or super-saturation of the supply wick therefor; provides means for manually supplying the fuel to the wick; and provides a simplified means for threading the wick in the torch structure.

Household Utilities.

HINGE FOR DAVENPORTS OR SOFA-BEDS.—J. SONTHEIMER, 1146 Emerson St., Lincoln, Neb. An object of the invention is to provide a hinge structure for use with sofa-beds adapted to properly connect the seat and back frames and the base, and at the same time admit of easy manipulation of the front and back in moving the same from one position to another.

ANIMAL TRAP.—T. V. CLAPP, 346 Main St., Springfield, Mass. The purpose here is



ANIMAL TRAP.

to provide a trap having a rod pivoted on a vertical axis, and disposed for moving in a horizontal pathway, the rod being [illegible] [illegible] in alinement with the [illegible] way, so that when the [illegible] the rod engages the [illegible] a horizontally hinged door, the door [illegible] when the rod is moved [illegible] side by the animal [illegible] either side the vertical portion of the rod to which bait is secured. A side sectional elevation herewith shows the trap with the door open.

GAS STOVE ATTACHMENT.—C. F. [illegible] and P. O'DONOHUE, 321 4th Ave., North, Nashville, Tenn. This improvement relates generally to attachments for gas stoves and more particularly it involves a device adapted to co-operate with the gas cocks in order to prevent accidental turning of the same, thereby preventing the escape of gas when so desired.

AUTOMATIC PIPE RELIEF.—J. X. PEACOCK, 82 Lockwood Ave., New Rochelle, N. Y. In plumbing systems in houses, and especially in the systems constituting the water heating apparatus, it frequently happens that the water in the pipes freezes, or due to other reasons, abnormal pressure is set up in the pipes which ruptures the latter and often results in flooding the house. To overcome this disadvantage means are provided for relieving the pressure on a pipe at a predetermined point.

Machines and Mechanical Devices.

PAN MAKING MACHINE.—W. O. DALY and L. LESIO, care of Lesio Turpentine Cup Company, Mobile, Ala. This invention is an improvement in pan making machines, and has for an object, among others, to provide a machine which can be operated by man power and thus be adapted for use by the consumer of the pans so that he can make pans as desired from sheets of metal.

ROCK DRILL.—T. J. BARNES and J. G. TRAVE, care of Western Machinery & Manufacturing Co., 1416 Wasee St., Denver, Colo. In the present patent the invention is an improvement in rock drills, of the valveless piston hammer type, actuated by fluid under pressure, and the invention has for its object a simplification of construction and an increase of efficiency.

SHUTTLE.—J. GAGNON, care of Joseph Ménard, 27 Grant Block, Fall River, Mass. Mr. Gagnon's invention has for its purpose the provision of a strong, cheaply constructed shuttle without lateral openings or cuts, and wherein means is provided for permitting the shuttle to be quickly and expeditiously threaded, and for preventing accidental unthreading.

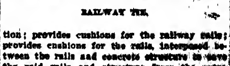
ICE MAKING DEVICE.—M. WALINT, P. O. Box 156, West Berwick, Pa. An object of this invention is to provide means whereby a number of blocks of ice may be quickly and cheaply manufactured through the agency of a freezing compound. A further object is to provide a machine for manufacturing ice which will accomplish the freezing of the water in very short time.

Railways and Their Accessories.

STATION INDICATOR.—W. B. HILL, Hotel Seneca, San Francisco, Cal. This improvement has for its object the provision of a device operated automatically by fluid under pressure or the like, and actuated either from the motor or the axle of the car, or from an independent wheel running on the rail.

SWITCH STAND.—S. F. PHILIPS, care of Goldstein & Miller, El Paso, Tex. The intention here is to provide a signal device for use in connection with the operating mechanism of a switch, for indicating by a visible signal the position of the switch, and means for operating the signal so arranged that the switch operating mechanism cannot be operated until the signal is set at danger.

RAILWAY TIE.—W. G. HOWE, 1773 Walker St., Des Moines, Iowa, and D. J. McDONALD. This invention provides ties wherein the life of the article is prolonged; provides ties in part constructed of concrete, the concrete being reinforced to support surface strains; provides a structure adapted for rapid installa-



RAILWAY TIE.

tion; provides cushions for the railway rails; provides cushions for the rails, interposed between the rails and concrete structure to save the said rails and structure from the extra wear by pounding of the rails on the ties; and provides fastenings for securing the rail to the ties, which fastenings are readily installed in position. The engraving shows a vertical longitudinal section of the tie, showing in full lines and in section a railway rail in service position, and in broken lines a rail in position preliminarily set for adjustment to service position.

SPIKE.—W. R. RIGGINS, Foreman, Extra Gang No. 6, G. H. & S. A. R. R. Co., Box 14, Sierra Blanca, Tex. This spike has [illegible] sides provided with a lower side wall whereby when the spike is driven into the tie the material thereof may come into engagement with the spike in the [illegible] and [illegible] walls thereby holding the spike securely. It has a double pointed end, the material of the tie

SPIKE FOR HOLDING RAILS ON TIES.

the sides of the spike, thereby holding it securely in position. The device is shown in partial vertical section in operative position.

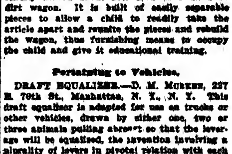
RAIL FASTENING.—G. H. WALKER, 6 Lorne Terrace, Halifax, Nova Scotia, Canada. The purpose in this case is to provide means for holding a rail in position on ties in such a manner as to cause the weight of the rail and the weight of a train moving over the rail to cause the fastening to more tightly retain the rail in position.

Pertaining to Recreation.

TOY WAGON.—E. C. SUSSARTEN, 930 Michigan St., Buffalo, N. Y. This wagon can be readily moved about and used as a sand or dirt wagon. It is built of easily separable pieces to allow a child to readily take the article apart and reunite the pieces and rebuild the wagon, thus furnishing means to occupy the child and give it educational training.

Pertaining to Vehicles.

DRAFT EQUALIZER.—D. M. MURKEN, 227 E. 76th St., Manhattan, N. Y., N. Y. This draft equalizer is adapted for use on trucks or other vehicles, drawn by either one, two or three animals pulling abreast so that the leverage will be equalized, the invention involving a plurality of levers in pivotal relation with each other and also articulated through the medium of springs. The equalizer is adapted for use



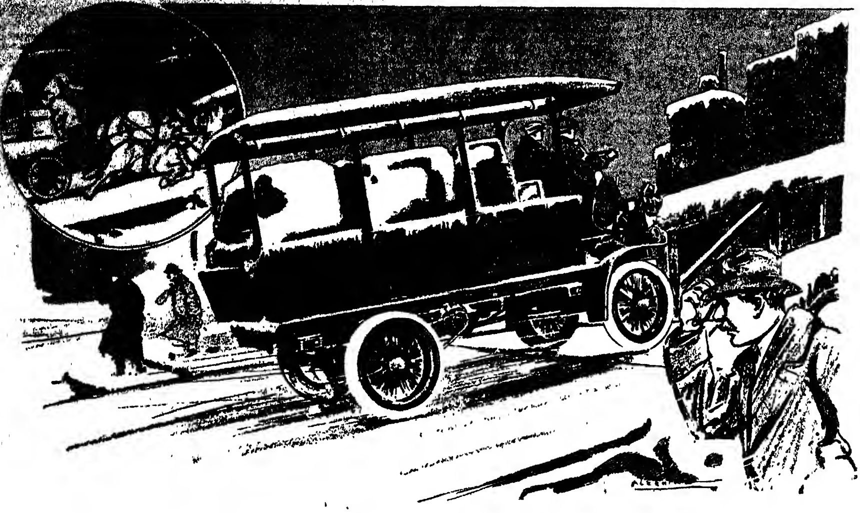
DRAFT EQUALIZER FOR TRUCKS.

with one, two or three swingle-trees, it being desirable in some instances that the animals used with vehicles be changed at short notice, and the structure of the device is particularly adapted for such change. The accompanying engraving shows a plan view of the device.

SEARCHLIGHT.—H. SALSBURY, 124 Long Acre, London, England, and T. WHITAKER, 14 Blandfields Street, Balham, London, England. The intensity of a beam of light projected from a lamp is here increased without adding to the size or power of the burner. A greater cone of light from the front of the flame is utilized than has heretofore been possible, this light being caused to fall on the main reflector so that the intensity of the beam produced by a given burner is greatly increased.

Designs.

DESIGN FOR A HANDKERCHIEF.—EDITH M. MINER, Colville, Wash. Inside the border of this ornamental design is a large field marked with numerous squares of relatively small size. Between the four sides of this centerpiece and the border are duplicated groups of a girl and two animals connected with one another.



GRAMM TRUCKS

Anticipate and prepare

WHEN the temperature goes *down* your horse-hauling expense goes *up*. The first flurry of snow *forces your horses to work slower than ever*. The first ice coated pavements are responsible for the thousands of accidents, falling horses, maimed horses, and horses that have to be shot.

The piling up of snow in the streets means *fewer* deliveries per mile, *smaller* delivery radius, and *more* out of patience customers. The huge snow drifts that form in the outlying and suburban districts, which your horses are absolutely unable to buck, mean a transportation expense, which, in the eyes of ordinary business judgment, *is a rank extravagance*. The cost of hauling merchandise (by horse) in the winter has, in some instances, been found to be greater than the profits on the goods delivered.

Winter, to the horse-hauling man, means perishing horses, damaged equipment, costly veterinary bills and big losses due to dissatisfied customers. Those merchants and manufacturers who still stick to the horse, lose hundreds of thousands of dollars every single winter, *which can be saved*. As you cannot change or control the weather the solution lies in *changing your equipment*.

The Gramm truck is as efficient in zero weather as it is in June. And in June one Gramm truck can do the work of at least three first-class teams. In some cases one Gramm truck can accomplish as much as four and even five teams, but this varies, according to the nature of your business.

Gramm trucks will plow clean through big snow drifts, without a bit of effort; will not be affected by a gale or a blizzard; cannot slip, slide or fall; operate as easily over icy pavements as over asphalt; do thirty miles of work at 10° *below* zero as readily as at 70° *above*; in short, *will make as many delivery stops in the teeth of a terrific snow storm as on the fourth of July*.

The rapid approach of winter is something every transportation man must face. Anticipate a little this winter. Think *now*, not after the season is too far advanced. Prepare for what you know is *bound* to happen. Be ready for the *most costly hauling period of the year*.

The Gramm truck has been in use for over ten years. It is built by practical truck builders in the largest individual truck plant in America. It is the most highly developed and practical truck built. We have studied transportation requirements and problems for years. What you are up against we can solve.

We will be glad to send our nearest representative or maybe you would prefer to call. Gramm transportation plans, equipment, facts and figures are worth your most careful consideration.

All advice and information gratis.

(Please address Dept. 6)

The Gramm Motor Truck Company, Lima, Ohio

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12711) D. M. C. asks: I claim that a 30-inch wheel, the periphery of which runs two miles a minute, has a greater centrifugal force than a 90-inch wheel with its periphery running two miles a minute. Am I right? A. The centrifugal force of a rotating body is given by the formula $F = \frac{m V^2}{r}$, m is the mass, V is the velocity, and r is the radius, or distance of the weight from the center of rotation. In the case which you propose the weight is not given, the rim velocity of the two wheels is the same, and so does not cause any difference between the two wheels in the result. There only remains the radius to be considered, and the larger the radius the smaller the centrifugal force, other factors being the same. Therefore, the larger wheel, if of the same weight as the smaller, has only one third the centrifugal force of the smaller. It may aid to the understanding of the question to consider that the small wheel has a much larger angular velocity than the larger with the same linear velocity of the rim. It turns through 360 degrees in one third the time of the larger wheel, but this does not affect the centrifugal force

(12712) G. W. P. writes: In Query No. 12,692, H. E. C. describes the formation of this conducting chains by the passage of current through a metal powder. This effect was first observed by Tommasina, and described in *Comptes Rendus*, December 12th, 1898 An abstract of Tommasina's article in the London *Electrician* of January 13th, 1899, reads as follows: "*Electric Cohesion.*—T. Tommasina has observed a peculiar phenomenon of adhesion or cohesion under the influence of the electric current, which may serve to elucidate some obscure points in the properties of coherers. He was engaged in experiments with an elementary coherer in the shape of a simple pendulum with a bob of nickel-plated brass resting lightly on a pinch of nickel filings, supported by a horizontal copper plate. The coherer was inserted in a circuit operating a relay, which lighted a small lamp when the current passed. The author found that when the copper plate was lowered the connection between the pendulum and the nickel filings was not immediately broken, but was maintained by a mobile and flexible little chain of filings, sometimes as long as 2 centimeters. Only one such chain was formed at a time. While it lasted it continued to keep the lamp burning. On cutting off the current the chain collapsed in a short time Filings of several metals were tried, and it was found that the chains were readily formed by the noble metals, but not by iron, magnesium antimony and bismuth The author does not attempt an explanation, but if the phenomenon is due to electrostatic attraction, it is evident that the contact between the particles must be very intimate indeed, and this is more likely to be the case in noble metals than in others Note that both Tommasina and H. E. C. were unable to form chains of *iron* filings. A. We had not seen the citation from the *Comptes Rendus* when we prepared the note in question, and very gladly give the credit to Tommasina for the original observation of the curious phenomenon.

(12713) C. E. W. writes: As a subscriber for over thirty years, and an occasional contributor, I venture to take exception to your answer (12591) to F. S. in your issue of November 2nd. Is this quite an adequate explanation? If it were true that all trees "grow toward the light and warmth of the sun," then every tree would point its top toward the *celestial equator* (for that is the sun's mean place) and would furnish a fair guide to the approximate latitude of the place where it stands. But the line of a tree's normal growth is *vertical*. The "light and warmth of the sun" hardly accounts for this, it seems to me. A. We do not think there is much difference between your statement and ours in regard to the growth of a tree We say that trees in forests grow vertically because of the influence of surrounding trees cutting off the light on the sides. Trees growing in small clumps or alone grow out on all sides, while the top extends up and away into the light, which comes in *every* direction from the sky, and not simply directly from the celestial equator as you state it. There is sufficient light on the north side of a tree to influence the growth of the terminal buds on that side, and to cause, in general, an upward turn to the branches. Our statement was evidently not intended to be a complete discussion of heliotropism, but only a sentence giving the general tendency of vegetable growth. A sprout on a potato in a cellar always turns toward the window, as we learned in our years of boyhood upon a farm in New England. There can be no question regarding the influence of the warmth of the sun upon the larger growth of the rings of wood on the south side of the tree trunk, and the wider spread of the branches to the south in the northern parts of the country. We thank you for your communication.

(12714) H. C. C. asks: I wish a description of a machine running with the power that a gasoline engine does, but only uses electricity generated by a dynamo [illegible]

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & Co., Inc.

Inquiry No. 9255. Wanted factory, store, shop or bank articles to sell by canvassing at a profit of from $1.00 to $3.00.

Inquiry No. 9256. Wanted household novelties or business necessities which can be retailed at from $1 to $5.

Inquiry No. 9257. Wanted to buy a machine which will reduce cobs to meal—not a machine for shredding the cobs, but a machine that will pulverize them.

Inquiry No. 9258. Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9259. Wanted substance melting at 225° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor.

Inquiry No. 9260. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9261. Want to buy machinery for manufacturing [illegible]

Inquiry No. 9262. Wanted a [illegible] that will stick labels to [illegible]

Inquiry No. 9263. Wanted the names and addresses of manufacturers of [illegible] clocks, also samples of such clocks.

Inquiry No. 9264. [illegible]

in such a machine invented. I have been informed that one of that description was on exhibition some time ago, the object of which was to run motor boats without the expense of gasoline. I write for information to find if such a machine has been invented and put on the market. A. We feel sure that no such machine as you describe can be successful, since a dynamo cannot produce electricity enough to run a motor and also to run itself as a generator, after starting it with a dry battery. Such arrangements have been tried many times and have always failed. No more power can come out of any machine than is put into it; nor even as much, since some power is always consumed in turning the machine itself, that is, in overcoming inertia and friction. If you are interested in the various ways in which men have tried to produce perpetual motion, we would refer you to our SUPPLEMENT, Nos. 1130, 1131, 1133, 1135, 1136, 1137, 1138, price ten cents each. They are fully illustrated.

(12715) W. D. J. asks: Will you kindly advise the common metal which has the least expansion from heat? Also the metal (common) which has the greatest expansion from heat? These metals should be able to withstand heat of 600 or 700 degrees without deterioration. A. We give you herewith the relative expansion and the melting point of several of the metals, having the least and the greatest expansion. They are taken in part from Kent's "Mechanical Engineer's Pocket Book," which we send for $5.00, and in part calculated from other sources. If the numbers given as relative expansions have four more ciphers prefixed, with the decimal point removed four places to the left, they will become coefficients of expansion, giving the amount of expansion for 1 deg. Fahr. per unit of length.

Metal.	Relative expansion.	Melting point, Fahrenheit.
Wrought iron	0.0646	2,740 deg.
Cobalt	0.0685	33,000 "
Nickel	0.0695	2,730 "
Copper	0.0887	1,900 "
Silver	0.1079	1,742 "
Aluminium	0.1284	1,157 "
Magnesium	0.1407	1,427 "
Zinc	0.1621	779 "

We would not warrant any of these metals not to deteriorate if kept at a temperature of 600 to 700 deg. Fahr. in the presence of moisture.

(12716) C. D. I. asks: It occurs to me that there must be a very decided gyroscopic effect from the rapidly revolving flywheel of an automobile motor. Placed as it usually is directly behind the radiator and parallel thereto, what would be its effect upon the motions of the car, and how powerful would this effect be? It would be interesting to me, and doubtless to many others, if you would answer these questions through the columns of the SCIENTIFIC AMERICAN. A. The flywheel of an automobile engine has, as you suppose, a gyroscopic effect upon the machine. Its numerical value depends upon the weight of the wheel and the speed of its rotation. It is not so great that it is difficult to steer the car. Some have tried to account for certain accidents in this way, but we doubt if the attempt is a success.

(12717) J. A. B. asks: In the electrolysis of water, where the poles of the battery end in two separate test tubes, filled with and inverted under the water for collecting the hydrogen in one and the oxygen in the other, how does the oxygen atom manage to travel to one tube and the hydrogen molecule pass over to the other tube? If the water molecule is decomposed at a point half way between the poles, and outside the tubes, would not the two gases form a bubble and rise directly to the surface of the water, and thus escape into the air? Or if the decomposition occurred at either pole, how does the gas liberated travel over to the other tube without escaping up through the water? I have tried to find these things explained in the new Encyclopedia Britannica, but the subject runs into ions, and right there I stop. I never fail to read your Notes and Queries, and often find the most valuable information, along the very lines upon which I had desired more light. A. Do not be afraid of an ion. It is quite innocent. It is simply a small particle of a substance which is carrying a charge of electricity on its back. It is moving about. The word *ion* means *going*, a traveler. Now hydrogen ions carry positive charges, and oxygen ions carry negative charges. When a little sulphuric acid is added to the water, a great many ions appear. They are somewhat different from simple hydrogen and oxygen, but we will let that go this time. They are there in the water all loaded and traveling about, a busy hustling multitude, jostling one another about. Now send a direct current of electricity through such a hubbub of traveling ions. Immediately a steady procession of ions starts up. The hydrogen ions with their loads of positive electricity travel to the negative pole and drop their loads of electricity upon it and appear as ordinary hydrogen gas. Before they were invisible ions. They become visible as gas when they lose their loads of electricity. The same is true of the oxygen ions. They unload and are just oxygen gas. No bubbles of gas can be seen in the liquid. No gas is seen until the loads of electricity are given up, and all the action seems to take place on the poles. We cannot explain the electrolysis of water or anything else without our ions, little travelers, and one who would understand and enjoy modern science has just got to get acquainted with them. They are great jokers, mischievous little Brownies, but they are quite ready and glad to make your acquaintance. They are among the most important little bodies in the chemical world. We chemists are very fond of our little ions, and they do us many a good turn to pay us for our attentions to them. Now you will not be afraid of ions.

The Fifteenth Annual Motor Number

For fifteen years the Scientific American has published an ANNUAL MOTOR NUMBER in which it has presented the most advanced information on developments in motor car design and construction.

Every number has been published only after consultation with men who are most competent to decide what was most valuable among the innovations proposed.

This year we have consulted not only manufacturers and users of automobiles, but also the more prominent designers who are members of the Society of Automobile Engineers.

The result will be a number that will give the very latest information on the new things in the world of motors.

Among the subjects that will be taken up are the following:

Automobile bodies, past, present, and future: An article which forecasts the appearance of the future car on the basis of developments in the past.

Partnership Ownership of a Car: A problem that puzzles friends who wish to stay friends.

Kerosene Engines, Carbureters and Converters: Gasoline is going up in price; kerosene is cheap. The kerosene automobile is coming. Hence this article.

How to realize economy with a motor wagon: Practical suggestions to those who have had experience in handling only dray horses.

Left side steering and center control: An innovation impartially discussed.

The capabilities of the motor truck and the horse compared: A typical illustration, of the graphic Scientific American kind, that shows what a poor piece of machinery is a horse, compared with a motor truck.

"What car can I buy for $500, $1,000, $1,500," etc.: A table which classifies American-made cars according to price.

A colored cover by Gerrit A. Beneker.

Price 15c. on all newsstands.

NEW BOOKS, ETC.

Colonial Homes and Their Furnishings. By Mary H. Northend. With numerous illustrations. Boston: Little, Brown & Co., 1912. 8vo. Price, $5 net.

Miss Northend's name is a familiar one to magazine readers. For some years she has been a steady contributor to the more important home magazines published in this country. As a writer on the home and its decorations, she has thoroughly familiarized herself with architectural styles and with furnishings. All this experience and knowledge is reflected in the book before us. Lavishly illustrated and beautifully printed, it conducts the reader into many of those historic dwellings of New England which may be regarded as the acme of architectural perfection and of good taste in interior decoration. There can be no question that Miss Northend has collected a valuable amount of material, which is here presented in such form that both the professional architect and decorator and the general public can profit by it.

The Modern Gasoline Automobile. Its Construction, Operation, Maintenance, and Repair. By Victor W. Page, M.E., Consulting Automobile Engineer. Formerly technical editor of the Automobile Journal. 500 illustrations; 10 folding plates. 694 pages, size 6 x 9 in. New York: Munn & Company, Inc., 1912. Price, cloth, $2.50.

Now that the automobile may be said to be standardized and its manufacture has become a national industry, it is time that a book should be published which can discuss it thoroughly and authoritatively with the assurance that the discussion will not be out of date two months after publication. Such a work Mr. Page has produced. Although other books on automobiles have been written, his may well be regarded as a product which, more than any other, is comparable with the best works on mechanical, steam, hydraulic and civil engineering. Too great praise cannot be given for the conscientious manner in which author and publisher have co-operated The one has manifestly given us the fruits of a ripe experience, the other has printed and illustrated the text worthily.

Most automobile manufacturers and motorists will profit by a study of Mr. Page's book. First defining the trend of modern practice, the author passes to a classification of the component parts of motor cars and considers the function of each group of mechanism The parts of typical pleasure car chassis are painstakingly described and illustrated. The reader is told how a typical chassis may be assembled, how truck parts are arranged, and is given considerable insight into the relation of wind resistance and body design. In the author's discussion of motive power, we naturally find a classification of the forms of power plants and the usual explanation of the difference between two and four cycle action There are clear accounts of typical single-cylinder engines, the *frequency of cycles* in one and two cylinder engines, as well as in multiple-cylinder engines In a modern work it is but natural that we should find considerable space devoted to the slide-valve motor, and Mr. Page has not only done so, but contrasted the slide valve with the poppet valve A chapter which will be read by manufacturers with interest and profit is that on engine construction

So, too, the discussion of fuels is remarkable for its exhaustiveness. Not only are the different kinds of fuels that can be employed in automobiles taken up both from their chemical composition and their mechanical efficiency, but carbureters, mixing valves, spray nozzles, are analyzed

Equally thorough are the chapters on ignition, lubrication, clutches and gear sets, etc. Of value to the designer is the chapter on the chassis and its components. A chapter helpful to the motorist is that on practical hints to assist in locating power plant troubles.

A word must be said for the illustrations. They are all line drawings very carefully prepared, very clear, and lavishly provided with legends that name each part. Indeed, we know of no book which can compare with this in the excellence of its technical illustrations

For its systematic and logical arrangement of subject matter we commend this book to the reader who desires to gain an understanding of the functions of each part of an automobile and the typical groups of mechanism.

Braunbecks Sport-Lexikon. Ausgabe, 1912-1913. Automobilismus, Motorbootwesen, Luftfahrt. Herausgeber Gustav Braunbeck. Berlin: Verlag Gustav Braunbecks Sport-Lexikon, 1912.

This is the third annual edition of a work which more or less constant use in this office has proven to be of considerable value. In the present edition the editor has omitted the older material to be found in the previous editions, but has referred to it. In this volume are recorded all the important events which have taken place in the world of the automobile, the motor boat, and aerial navigation

Hopson on Auction. By Francis Johnstone Hopson. The New Count "Royals." New York: E. P. Dutton & Co. 12 mo.; 86 pp.

This book is up-to-date, inasmuch as it gives in a simple and direct manner many hints in regard to playing Auction under the rules of the new count. The principal laws of team play in this new game are placed before the reader in a clear and concise manner. The laws of Auction bridge as adopted by the Whist Club, with the amendments of December, 1911, are published through the courtesy of the Whist Club.

Sending Photographs over a Telephone Wire

(Concluded from page 540.)

so designed that they will prevent reflections which might fog the picture. Since the elevations on the gelatin prints on the transmitting cylinder constantly displace the conducting plate of the rheomicrophone and the current that is sent through the line varies in intensity proportionally to the elevations and depressions of the original gelatin print, the mirror of the oscillograph in the receiving apparatus moves almost constantly. Because of the mirror's movement the pencil of luminous rays reflected is turned from right to left, from the center to the edge of the lens. It encounters the series of screens which reduce its luminous intensity more or less. On the other hand, since the sensitive film has been placed in the right position relatively to the mirror, the opening is continually illuminated. Hence when the pencil of rays falls on the center of the lens, the absolute transparency of the interposed screen produces no extinction whatever. The luminous impression is a maximum, corresponding with a black portion on the original print. But if the luminous rays are reflected to the edge of the lens, the absolute opacity of the screen interposed causes a complete extinction of light and hence white is produced. For all the intermediate positions of the reflected bundle of rays, the scale of screens determines the corresponding halftones and the desired photographic effect is obtained.

By various mechanical means the series of screens can be very exactly graduated and the rotation and sensitivity of the oscillograph controlled. The image received conforms absolutely with the original. In one of the accompanying illustrations we reproduce a picture transmitted over a line 450 miles long.

Solution of the Steel Rail Problem

(Concluded from page 533.)

of each grade steel were made; they forged well and were found satisfactory

TABLE I. WASTE AND USABLE PRODUCT FROM 14 MILD STEEL INGOTS.

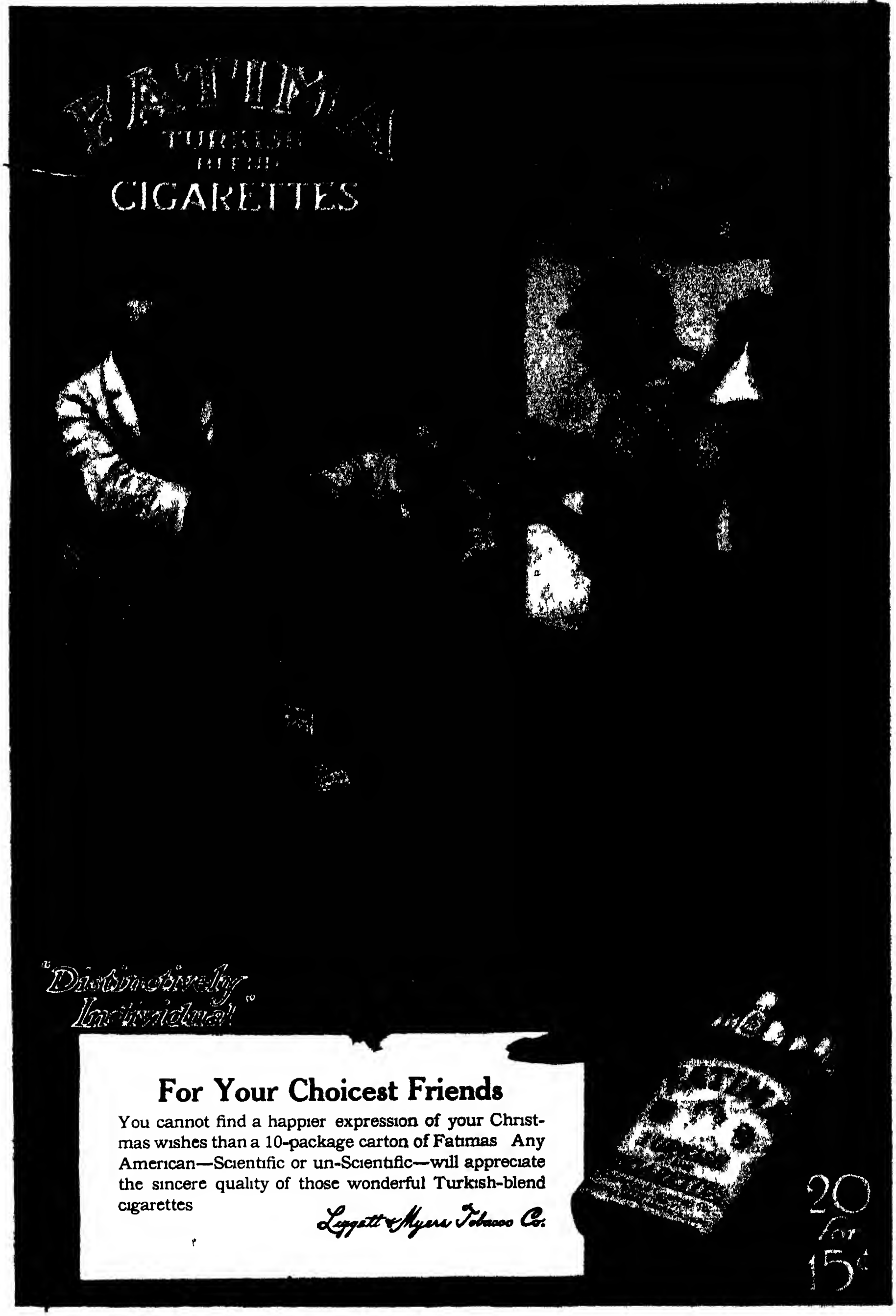
	Per Cent
Head scrap	6.0
Billet scrap	1.0
Forge waste	1.8
125 billets	91.2
Total weight, 15,400 lb	100.0%
Total waste	8.8%

TABLE II. WASTE AND USABLE PRODUCT FROM 14 MEDIUM-STEEL INGOTS

	Per Cent.
Head scrap	5.6
Billet scrap	0.7
Forge waste	1.6
128 billets	92.1
Total weight, 15,340 lb	100.0%
Total waste	7.9%

In conclusion, attention is drawn to the four illustrations at the bottom of page 538, showing the results obtained with an eleven-inch ingot, weighing 1,650 pounds. It will be noted that when the ingot had been rolled down into blooms aggregating thirty feet in length, it was necessary to discard only two feet six inches. A section at the inner end of this discard showed only a slight evidence of pipe. A section at a point one inch farther down the bloom showed absolutely sound material without any sign of pipe.

Now here is a process, which, if it were adopted by American rail manufacturers, would enable them to furnish the railroads with a rail that was absolutely sound and free from the lurking menace of piping. The inventor has found that the decreased cost per ton due mainly to reduced discard is from two to three dollars. We believe the present price of rails in the market is about $28 per ton; and we venture to believe that if the railroads, especially those in the East, where the traffic is heavier and the weather conditions are more trying, could by the payment of slightly more to cover the cost of installing the plant, secure absolutely sound rails, they would be found ready to do so. If we read Sir Robert Hadfield's paper aright, however, the total cost of the output, if it were large, would be reduced.


FATIMA
TURKISH BLEND
CIGARETTES
"Distinctively Individual"
For Your Choicest Friends
You cannot find a happier expression of your Christmas wishes than a 10-package carton of Fatimas Any American—Scientific or un-Scientific—will appreciate the sincere quality of those wonderful Turkish-blend cigarettes
Liggett & Myers Tobacco Co.
20 for 15¢

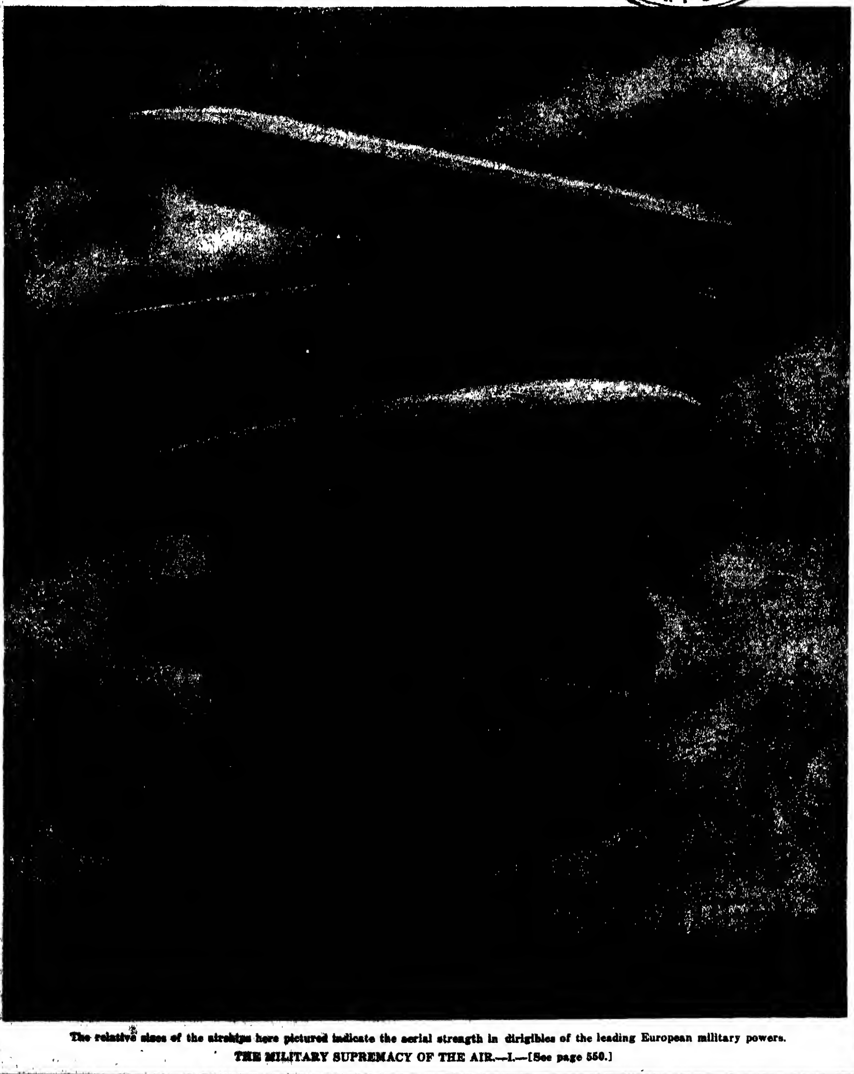
SIXTY-EIGHTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, DECEMBER 28, 1912

PRICE 10 CENTS
$3.00 A YEAR



The relative sizes of the airships here pictured indicate the aerial strength in dirigibles of the leading European military powers.

THE MILITARY SUPREMACY OF THE AIR.—I.—[See page 550.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, DECEMBER 28, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries one year, postage prepaid,	4.50
Subscriptions for Canada one year, postage prepaid, ...	3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year,	$3.00
Scientific American Supplement (established 1876) . "	5.00
American Homes and Gardens . . . "	3.00

The combined subscription rates and rates to foreign countries including Canada will be furnished upon application.
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Automatic Railroad Stop

THE propaganda of "Truth" which the New York, New Haven and Hartford Railroad Company is carrying on through its president, Charles S. Mellen, is something unique in the history of railroads. Commencing with the letter of Vice-President McHenry in our issue of November 16th, replying to our article of October 26th on the Westport wreck, these Bulletins of truth (or whatever they should rightly be called) by the railroad company, have been continued in the public press in a series of large-type statements headed "Truth" and numbered consecutively. Acting on the suggestion of the Interstate Commerce Commission that "railroads ought to unitedly experiment with the automatic train stop until a device of practicability of general use shall be available," Mr. Mellen announces in his third bulletin that a reward of $10,000 will be paid to whoever shall first invent an automatic device that will safely arrest an express steam locomotive that has passed the danger signal.

We congratulate Mr. Mellen on being the first prominent railroad official to recede from the altogether untenable and illogical position which has been held for many years by railroad men, on the question of the automatic stop and other devices designed to take the operation of trains out of the hands of careless employees at the critical moment and automatically safeguard the lives of the passengers. The railroads have claimed that automatic railroad operation induces carelessness, the employees depending upon the automatic devices and ceasing to exercise that vigilance which is required of them. This extraordinary attitude cropped up during the Interstate hearing on the Westport disaster, when the New Haven officials stated that the introduction of easier cross-overs would make matters worse, since they would tempt the engineers to run over them even faster than they were now doing. Mr. Mellen evidently is still of that opinion; for in his "Truth" No 2 he says: "Had the cross-over (10) been a No 20 the result would have been the same"—a statement the fallacy of which any high-school graduate, of average intelligence and with an elementary knowledge of physics, would prove to Mr Mellen's satisfaction in a few minutes time. If "the result would have been the same," why in the world is Mr Mellen giving orders to replace the No 10 by No 20 crossovers on his line, as he tells us he has done in the very next paragraph of "Truth" No. 2?

However, we are greatly encouraged to learn that at least one great trunk railroad is prepared to install the automatic stop, if one that is practicable under all weather conditions can be designed; for this means that when a home signal, set at danger, says "Stop!" trains *will* stop, *and will wait until the signal arm has dropped before proceeding into the next block*. At present the engineer stops, and, by permission of the railroad, is allowed to advance "cautiously" to find out where the obstruction is. He is expected to do this, without running into the broken rail or the track wrecker's obstruction or the stalled train and so making confusion worse confounded. Sometimes he succeeds and sometimes there is a collision.

The railroad officials do not like the automatic stop. They fear that it will "slow down" traffic. They believe that the fundamental principle of safety embodied in the phrase "no two trains in the same block at the same time" is unworkable. They will tell you that the home signal may be at danger because the electric apparatus governing the automatic action is out of order, and that in this case the train might be held up indefinitely. In answer to this, it is sufficient to say that a simple telephone line extending from the signals to the dispatcher's office would enable the conductor quickly to ascertain the facts.

That the automatic stop is practicable in every way, that it is safe, accurate and not an interference with the operation of a dense, fast traffic, is proved beyond all disputation by the results obtained on the New York Subway, where the stop has been installed for many years. Signal Engineer J. M. Waldron, of the Interborough Company who operate the subway, tells us he is satisfied that, with slight modifications, the automatic stop as used in the subway could be applied to trunk railroads operated by steam—and surely this gentleman ought to know.

Let us look at results on the subway, which in regard to the density of traffic, and the small headway of 1 minute 48 seconds under which trains are run, presents the most difficult problem of operation by block signals in the world. Recently, during six days, this system carried 6,505,000 passengers. Of this vast total from 70 to 75 per cent was rushed over the express tracks at speeds of 40 to 50 miles per hour, under the protection of the automatic stop, and of course, of the automatic signal system. The record of signal and automatic stop failures shows that signals have failed once out of 401,115 movements and that the automatic stop has failed once out of 277,846 movements. In other words, there has been one signal failure in about three years and one automatic stop failure in a period of over two years.

Of course this wonderful record is due partly to the fact that the signals and stops operate under ideal weather conditions, being under shelter. For steam road operation some modifications would be necessary; but as the result of an investigation which we have made among signal manufacturers and railroad men who have had wide experience, the conviction is borne home upon us that, if the railroads really wish to install the automatic stop, if they are willing to spend ten times $10,000 for experimental work that might be required of them or of any individual inventor, and if their eminently qualified staffs will assist in the development of a suitable device, they will not have to wait till 1915 to find the desired mechanism. This $10,000 offer will help; but is nothing compared to what the railroads themselves might do, if they would take a leaf out of the book of the General Electric Company, whose counsel testified recently in Washington that the company spent several million dollars in experimental work to perfect the Curtis steam turbine.

The Bureau of Chemistry's New Chief

ALTHOUGH the general public knows very little about Dr. Carl Alsberg, his appointment as the Chief of the Bureau of Chemistry will no doubt commend itself to those who are familiar with his career. He is but thirty-five years old, young enough to bring to his task enthusiasm and energy and old enough to exercise the sober judgment and discretion to be expected of a man no longer in his twenties. His academic training is all that can be desired; for he has studied under brilliant professors of chemistry in the leading universities of Germany and the United States. Indeed, so far as the mere matter of academic qualifications is concerned, Dr. Alsberg is probably better off than almost any official who has been connected with the Department of Agriculture in late years. The importance of that can hardly be overestimated. The Bureau of Chemistry needs as its chief a man who has the correct scientific attitude toward the solution of the highly important problems which are assigned to the Bureau of Chemistry. Association with teachers on both sides of the Atlantic, who have spent their lives in the search of scientific truth, is the most effective way of securing that attitude. Because of these associations and because of his training, we are convinced that Dr Alsberg's appointment is fortunate for the Bureau and the public.

The duties of the new head of the Bureau of Chemistry will be peculiarly onerous. Dissensions in the Bureau itself, petty jealousies, a public press which has come to believe that food adulterators, rather than the incompetence of the Bureau of Chemistry itself, have prevented the efficient administration of the Pure Food and Drugs Act, and lastly, the supervision of the Referee Board, are perils, the braving of which will test the tact, the courage, and the executive ability of the new chief. We hope that Dr. Alsberg will perform his new functions with such efficiency that it will no longer be necessary to maintain at considerable public expense a Referee Board to check up the work of the Bureau, and that the investigations of the Bureau will henceforth be respected the world over for their scientific trustworthiness.

Sea Strength of the Great Navies

OF the many published estimates of the relative sea strength of the leading navies of the world, probably none is so accurate as that which is issued annually by the Office of Naval Intelligence of the Navy Department. The Navy, through its naval attachés and its naval officers [illegible] throughout the world, has unusual facilities for [illegible]ering information of this kind, and the [illegible] edge of this nature, published under date of Dece[illegible] 1st, 1912, possesses unusual interest at a time [illegible] naval construction throughout the world has assu[illegible] such enormous proportions.

Unless the prognostications of naval strategy [illegible] tactics have been wrongly made, the fortunes of wa[illegible] future naval campaigns will be decided chiefly by t[illegible] modern type of fighting ship known as the dread-nought. Other things being equal, the nation which can put the largest number of these ships into the fighting line will have the command of the sea and the prizes of victory secure within her grasp. Let us, then, give first attention to the question of the relative strength of the leading navies in ships of the dreadnought type. We include both the battleships and the large and fast armored cruisers; and since ships are built and commissioned very rapidly in these days, we will base our comparison upon the combined totals of dreadnoughts, built, building or authorized. We find that England heads the list with 86 such ships, Germany being a strong second with 23, followed by the United States with 13; Russia, 11; Italy, 8; France, 7; Japan, 7; and Austria, 4. The significant fact for us in this comparison is that Germany, than whom we were stronger a few years ago, will within the next few years have 23 dreadnoughts against our 13. And yet Congress was guilty of the unspeakable folly, this year, of cutting down the modest request of the Navy for two battleships to one. We should build three at the very least next year, in order to keep up with our yearly programme.

In battleships of the pre-dreadnought class with mixed armament, the order is England, 40; United States, 25; Germany, 20; France, 20; Japan, 13; Russia, 8; Italy, 8; Austria, 6. In the destroyer class the order of strength is, England, 184; Germany, 131; Russia, 107; France, 84; United States, 56; Italy, 35; and Austria, 18. Of submarines England has 86, built, building or authorized; France, 89; United States, 47; Russia, 39; Germany, 32; Italy, 20; Japan, 16; and Austria, 13.

When all the vessels now building are completed the relative order of tonnage will be Great Britain, 2,478,-152 tons; Germany, 1,124,267 tons; United States, 898,-435 tons; France, 806,729 tons; Japan, 613,724 tons; Russia, 459,207 tons; Italy, 416,310 tons; Austria, 269,-761 tons. Here we see that not only has Germany secured a long lead over the United States, but that France will soon be contending with this country for third place.

We are hearing a good deal just now about the grouping of powers in Europe. Arranging the above figures respectively under the Triple Entente and the Triple Alliance, we find that the Triple Entente will have 64 dreadnoughts, the Triple Alliance 35. The Triple Entente will have 68 pre-dreadnoughts, the Triple Alliance, 34. The Triple Entente will have 375 destroyers, the Triple Alliance, 184. The total tonnage when all ships now building are completed will be: for the Triple Entente, 3,744,088 tons, and for the Triple Alliance, 1,801,-420 tons.

Solar Radiation

IT is often stated that astronomy has little or no practical value to-day. However much this may seem to apply to some phases of this most interesting line of investigation, it certainly cannot be urged against efforts made to determine the amount and character of the sun's heat. Every living thing receives the greater part of its energy from the sun. Atmospheric circulation and climate are dependent upon the same source of heat. If, therefore, it will be possible to find the exact amount of heat we receive from the sun; if we can determine whether or not it varies from day to day, and, if so, according to what law; if we can connect solar radiation with climate and weather, it would be of untold value to all mankind.

The Smithsonian Institution of Washington has for many years made special studies on solar radiation and easily ranks first in this regard. Evidence has been brought forward by Prof. C. G. Abbot, director of the astrophysical work of the Institution, that the amount of heat radiated by the sun is not constant. With present appliances, however, it has not been possible to determine whether the whole surface is effective in this or not. In order to attack this problem the Smithsonian Institution is erecting, at its station on Mount Wilson in California, a "tower" telescope, forty feet high. This instrument will be very similar to the 60-foot tower telescope of the Mount Wilson Solar Observatory, a cut of which will be found on page 156 of our issue for February 17th, 1912. The new telescope will also be used in studying the intensity of light from the sky and the reflecting power of clouds.

When completed this instrument will be a powerful means of grappling with some of the great problems of solar physics, and in the hands of Prof. Abbot and his assistants we feel sure of its efficient use to this end.

Engineering

Extending the Galveston Sea Wall.—The present sea wall at Galveston, finished in 1906, which extends for a distance of four and one half miles around the city, is to be extended, at a cost of about five million dollars. It is expected that the extension will provide an elevated area, protected by sea wall, which will accommodate practically double the present population of 41,000.

Panama Canal Excavation.—In spite of a rainfall for the month of October of 14.01 inches, the total amount of excavation at the Panama Canal reached 2,584,823 cubic yards, which works out at a daily average of 95,734 cubic yards for 27 working days. There was placed in the dam 332,531 cubic yards of fill, and 66,754 cubic yards of concrete was laid.

Present Status of Panama Canal Work.—According to the canal record, a supplementary estimate of work that must be done to complete the canal was made November 1st, from which we learn there has been an increase in excavation since 1908 of over 36,000,000 cubic yards. The present grand total of excavation, estimated, is 211,361,000 cubic yards, and on November 1st there remained to be taken out only 28,391,000 cubic yards.

New Commander-in-Chief of the Atlantic Fleet.—Early in January Rear-Admiral Badger, the future commander-in-chief of the Atlantic Fleet, will relieve Rear-Admiral Osterhaus and will hoist his flag on the "Wyoming." This vessel is the latest and most powerful of our dreadnoughts, carrying, as she does, twelve 50-caliber, 12-inch guns, mounted in six turrets. Her presence in the review recently held in the North River made her familiar to residents of New York and vicinity.

A Thirty-five Knot Torpedo Boat.—The British destroyer "Lurcher," during an official sea trial of eight hours, achieved a mean speed of 35.34 knots, or 3.34 knots above the contract speed of 32 knots. The trial, of course, was run in deep water. The "Lurcher" is one of three destroyers 265 feet in length by 25 feet 7 inches in beam. They are driven by twin Parsons turbines, and these vessels will constitute the fastest of their class in the world.

Oil Engines in the British Navy.—The fact that five different sets of marine oil engines are being constructed for the British navy, shows that the Admiralty is taking up the question of the best type of marine oil engine with characteristic thoroughness. One set will be of the Fiat type, another will follow the principle of the Nürnberg type, two of the other sets are to be low-speed engines and the fifth is to be of the high-speed type. In all cases the engine will be of the four-stroke cycle, reversible type, and the power will range from 500 up to 2,500 brake horse-power. Various types of auxiliary installation will be tried out. The auxiliaries on one ship will be driven by small-tube steam boilers, and in the other cases compressed air or electricity will be utilized. The resulting data will be of the greatest value.

Electrifying the New Haven Railroad.—For several years the electrified zone of the New Haven Railroad, extending from Woodlawn to Stamford, has been in successful operation. The company is now engaged in extending the zone as far as New Haven, and it is expected that this section will be open by July 1st, 1913. The new work will embody such improvements as have been suggested by the experience gained in operating the existing stretch of track. One of these will be a rearrangement which will eliminate the effects of electro-magnetic induction on adjacent telegraph and telephone systems, which heretofore caused much trouble and interruptions in service. It will be remembered that the overhead line carries a pressure of 11,000 volts.

Award of John Fritz Medal.—Founded in 1902 in honor of the ironmaster whose name it bears, the John Fritz Medal has been awarded for this year to Capt. Robert W. Hunt of Chicago. The medal is intended to commemorate notable scientific and industrial progress. Capt. Hunt, an engineer of world-wide celebrity, served in the Civil War from 1861 to 1865, and has been widely known for his work in many branches of engineering. Previous awards of the medal have been made to Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas A. Edison, Charles T. Porter, Alfred Nobel, and Sir William White.

Some Figures of Coal Production.—During the year 1910, the total coal production of four States, Alabama, Maryland, Pennsylvania and West Virginia, amounted to 233,500,000 tons. What this means will be understood when it is stated that the total output for the whole United Kingdom in the same year was 264,300,000 tons. In 1900 the total output for the world was 768,000,000 tons; for the United Kingdom 225,175,000 tons, for the United States 269,675,000 tons, and for the four States named above it was 114,200,000 tons. To-day the world's output has risen to 1,164,000,000 tons. The United Kingdom produces 264,300,000 tons, and the United States 501,600,000 tons; from which it will be seen that the output from the United States is nearly one half that of the whole world.

Science

Dr. George C. Simpson, late physicist of Capt. Scott's Antarctic expedition, has returned to his regular duties under the Meteorological Department of India, after an absence of three years.

Australian Radium.—According to the London *Times*, the first sample of radium bromide produced outside of Europe has just been manufactured in Sydney from Australian ores, and has a certified purity of 98.4 per cent. The plant is capable of producing 40 milligrammes weekly.

The Royal Geographical Society is considering the question of admitting women as fellows on the same basis as men. The same question was raised in 1893, when the council of the society actually elected a number of lady fellows; but their action was not sustained by a majority of the society, and the controversy that ensued resulted in the resignation of the president.

Metallic Sponges.—A Danish scientist, M. Hannover, has invented a metallic sponge, which has recently come into industrial use. It is composed of an alloy of lead and antimony, and consists of a loose-meshed network inclosing spaces of larger or smaller size. It is employed for absorbing resins, oils, etc. A description was given to the French Academy of Sciences by M. Le Chatelier and is reported in *La Revue*.

How to Get Rid of the Odor of Linoleum.—*La Nature* gives the following recipe: Mop the linoleum with a sponge or a piece of old carpet wetted with diluted javelle water (1 to 10). Leave over night, closing all doors and windows; next morning air thoroughly, and over the dried surface pass lightly a mop wet with water containing 10 per cent sodic bisulphite. Leave again over night with doors and windows closed. Next morning wash several times thoroughly with water.

A Magnetic Survey in the Sahara.—The Department of Terrestrial Magnetism of the Carnegie Institution of Washington has dispatched two magneticians, Messrs. Berky and Sawyer, from Biskra, Algeria, to Timbuktu. They are accompanied by a caravan party, and will spend four or five months in the trip, in the course of which important additions will be made to the great body of magnetic data that the department is gathering from unsettled and uncivilized regions of the world.

The Highest Vacuum Ever Attained Experimentally.—We talk rather glibly of high vacua, or even of a perfect vacuum. It is instructive to calculate the number of molecules contained in a cubic millimeter of gas at the lowest pressure on record. W. Gaede has recently succeeded in exhausting a vessel to a pressure of two ten millionths of a millimeter of mercury (four one thousand millionths of a pound per square inch). At this pressure one cubic millimeter of gas would still contain about eight and a half-million molecules—a number equal to nearly twice the population of New York city.

International Measures Against Plant Diseases.—For some time past the International Institute of Agriculture has been urging the idea of co-operation among the nations of the world to check the spread of plant diseases. The only approach to concerted and uniform action in this direction at present is that taken under the International Convention against Phylloxera, adopted by certain countries of continental Europe in 1878. At last the first steps have been taken toward bringing about more general co-operation. A notable discussion on this subject was held at the recent Congress of Comparative Pathology, in Paris, the attendance at which included the foremost plant pathologists of Europe. It was finally decided that the French government should undertake the arrangement of an international meeting of plant pathologists in Rome next April, which will, in its turn, draw up recommendations to be submitted to the general assembly of the International Institute of Agriculture, which meets next May.

For Extracting the Principle of Plants.—A new method of obtaining the active principles of plants in the state in which they exist in the fresh plant is used with success by the French scientist, Prof. Perrot, of the Paris School of Pharmacy, and together with M. Goris he employs a special method of treating plants for medical use. In this way he obtains extracts of a different nature from what are given in the usual processes where dried plants are employed. Such extracts can be used to great advantage as they contain the active principles of the plants in a more suitable and unaltered form. Thus, by his process, the leading active principles such as alkaloids or glucosides and diastases are preserved in their complex combinations such as they existed in the cells of the plant, and under this form it is found that their action on the human body is identical with that of the fresh plant. Such combinations are rendered stable by treating the sterilized powder of the freshly dried plant by alcohol so as to make an extract. This is then evaporated in vacuo and then freed from fatty matter, wax or resin, then dried by a cold process. Such extracts are soluble in water. A description of the above method was laid before the Academy of Medicine in a recent paper.

Aeronautics

Garros's New Height Record.—On December 11th Roland Garros made a new height record at Tunis, Algeria, of 5,801 meters (19,031 feet). This new record was made with an 80 horse-power Morane-Saulnier monoplane, which is the same make of machine that was used by Legagneaux when, on December 17th last, he made a record of 17,880 feet at Villacoublay. While Legagneaux required only 55 minutes to reach this height and descend to earth again, Garros, in attaining 1,152 feet greater altitude, took one hour, one minute, and six seconds. A week later, on December 18th, Garros made a wonderful oversea flight from Tunis across the Mediterranean to Sicily. He covered a distance of 160 miles and landed near Trapani. French torpedo boats were used to guide him, and he flew at a great height.

Omaha to New Orleans by Hydro-aeroplane.—On December 16th Antony Jannus finally reached New Orleans in his Benoist tractor hydro-aeroplane, fitted with a Roberts 75 horse-power two-cycle motor. Jannus has been nearly two months making the trip, which was accomplished above the Missouri and Mississippi rivers. A good part of the distance, which totals over 1,900 miles, he carried a passenger. At the start of his flight Mr. Benoist attempted to keep up with him in an automobile, but he was unable to do so. Jannus made exhibition flights at various places and demonstrated the possibility of touring in a hydro-aeroplane, even under unfavorable weather conditions. Almost every flight he made was either started or finished in the rain. Nevertheless, Jannus persevered and finally reached his goal without having experienced any severe accident. The Benoist biplane is fitted with a monoplane body, and has a novel feature in the form of warpable balancing planes located between the main planes at each end of the machine.

Aeroplane Flights in the Balkan War.—Almost every day news comes from the scene of activities in the Balkan war of flights made by military aviators. The first Bulgarian aviator to lose his life in this war was Lieut. Tarraxtcheff, who was sent out by Gen. Yankoff early in the war to reconnoiter Adrianople. His monoplane went wrong and he crashed to the ground and was killed as the result of his injuries. The Russian aviator, Poppoff, was also killed as a result of his machine catching fire in the air and falling to the ground, and on December 6th Dr. Constantin, the one time assistant of Dr. Doyen, a well-known French surgeon, was shot while making a flight. He managed to descend, and the machine alighted safely at the Bulgarian camp with the dead aviator, who had been shot in the breast, still clutching his control wheel. The barograph showed that he had been up to a height of 4,000 feet. He had flown over a Turkish fort and taken photographs and had evidently been shot in the act. His biplane was riddled with bullets, but this did not seem to affect its flying qualities. Thus once again was demonstrated the necessity of protecting the aviator with armorplate if he is going to engage in active warfare. The only aviator employed by the Turks appears to have been the Frenchman Letort. He made several reconnaissances of two to three hour's duration, and brought valuable information to the Turkish commander. A breakdown to his engine caused him to alight behind the Greek lines and he was captured. The latest cable news is to the effect that on the 19th inst. a Greek aviator, Montoussis, and his passenger dropped many bombs upon the fortified town of Janina, seriously damaging the principal buildings and terrorizing the inhabitants.

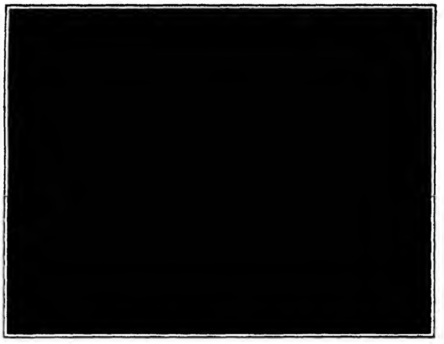
Recent Aeroplane Fatalities in England and America.—On the 15th inst. two double aeroplane fatalities occurred in England and the United States. Lieut. Parke, R.N., was carrying a Mr. Hardwick as passenger in his Handley-Page monoplane and flying from Hendon to Oxford. He left the aerodrome at noon and was traveling 50 miles an hour in a choppy wind at a height of some 300 feet when the monoplane suddenly dove to the ground, killing both aviator and passenger instantly. Lieut. Parke was an excellent aviator and had done considerable cross-country flying. Some months ago he faced certain death in a spiral dive from which he miraculously escaped by making what had heretofore been thought to be exactly the wrong maneuver. The American fatalities occurred with a hydro-aeroplane in which aviator Horace Kearney and a newspaper reporter named Chester Lawrence were attempting to fly from Los Angeles to San Francisco. This flight was started over the Pacific Ocean, which had been agitated for three days by a 30-mile gale. Aviator Glenn M. Martin, while searching for Kearney, was nearly drowned also by landing in the rough sea when his motor gave out. A pontoon of Kearney's machine was located first, and several days after part of the wrecked aeroplane was found. The bodies of the two men were finally found nine miles from the starting point. Stopping of the motor and a descent in the rough sea demolished the aeroplane and drowned its occupants. Their fate should be a lesson to all aviators not to attempt foolhardy flights.

The Sing Sing Motor Dumping Truck

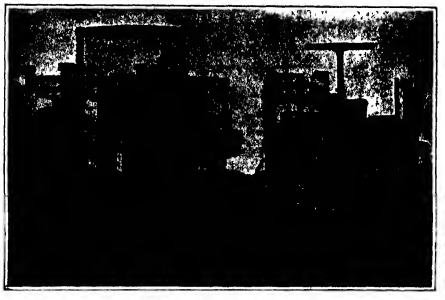
EVER since he has been associated with the Department of Street Cleaning of the city of New York, Commissioner Edwards has endeavored to introduce improved methods of collecting ashes, garbage and other refuse It was apparent to him that the system of using small ash carts with a capacity of a single cubic yard each was not very economical. As a result of very careful tests it was proved that the most economical unit was a truck that would carry nine cubic yards The Commissioner has also endeavored to displace horses with motor trucks, and experiments this summer proved conclusively that the motor truck offers material advantages over the horse-drawn vehicle in the matter of time and money.

About two years ago the Commissioner visited the State prison at Sing Sing, where there is a shop in which steel dump-carts are constructed by the prisoners He suggested to the Superintendent of Industry that the Street Cleaning Department of New York needed a motor-driven truck of large capacity, and forthwith the task of building such a truck was undertaken at the prison The difficulty of this task will be realized when it is known that the 18 or 20 men employed in that shop had never worked on an automobile before and knew nothing about machinery except what they had learned in the course of their labors in the prison Previous to their imprisonment they had been bakers, bartenders, longshoremen, sailors and laborers The Department of Street Cleaning informs us that the men took a great interest in the new machine and entered into the work with enthusiasm. Any literature that they could get hold of on the subject of automobiles and their construction was read with avidity, and they spent their leisure hours studying the plans and endeavoring to solve various problems of design. One man, who became ill during the construction of the machine, sent suggestions from his bed in the hospital, and, when dying, said that he would be satisfied if he could live to see the finished truck and ride in it once around the yard.

The machine has only just been completed and may now be seen on the streets of New York, where it is under going a rigid test. The truck is constructed of steel and has a body with a capacity of five cubic yards However, there is a wooden cover over the body which may be piled up with two or three cubic yards more The particular advantage of the truck is that the body is hung very low, so that it may readily be loaded To save time, the truck need not be stopped while being loaded, but may travel slowly forward at the rate of a slow walk while the cans are being dumped in it. A novel dumping gear is provided consisting of a worm and sector. The dumping gear is driven by the truck engine through a clutch mechanism operated by the driver By reversing the gear, the body is returned to its normal position The cover over the body is provided with a number of doors, so that the load may readily be distributed Only one of the doors can be opened at a time, so that the dust is confined within the body This is a great advantage over the carts heretofore used, which have been either open or partly open, and the resultant dust when loading was very annoying to passers-by. At the rear of the cover is a door which opens automatically when the body is tilted to the dumping position. The dumping gear moves the body to an almost vertical position, which is possible because the fulcrum is placed back of the rear axle. The operation of dumping is completely automatic. The entire machine is very staunchly built and the mechanism is practically "fool-proof." So far the tests of this machine have been very satisfactory, and it is quite probable that the city will profit materially from the devoted industry of the convicts.



The insufflation apparatus in use.



Dr. Janeway's insufflation apparatus.

Dr. Janeway's Insufflation Apparatus

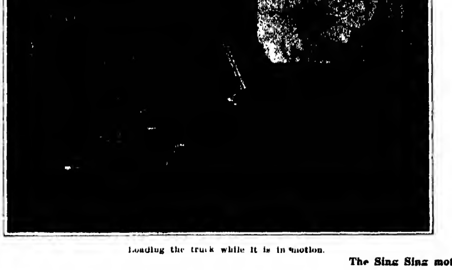
By John B. Huber, M.D.

SOME time ago we considered "cloudland surgery," such as Dr. Willy Meyer does in an apparatus devised and perfected by him and his brother—the latter a mechanical engineer. This apparatus is especially appropriate when operations within the chest are to be done Until the elaboration of some such apparatus, the thorax has been about the last region of the body uninvaded by the surgeon. The reason is that when this cavity was entered, the tender and resilient pulmonary tissue, no longer protected by the intact chest wall from the normal air pressure of fifteen pounds to the square inch, must needs collapse, so that respiration becomes impossible and death supervenes. The apparatus of the Meyers consists of an outer chamber in which the atmosphere is so rarefied that a negative (—) air pressure results, about equivalent to the atmosphere breathed at an altitude of 1,800 feet above sea level—that is, in cloudland. Inside this negative pressure chamber is a positive (+) pressure chamber in which the atmosphere is denser than that ordinarily obtaining, and which accommodates only the anæsthetizer *and the head of the patient*—the latter's neck being guillotined by a rubber ring, while the rest of his body is in the "negative" chamber. Thus the possibility of lung collapse is still more obviated, the negative pressure upon the torso in the larger chamber being still further counter-balanced by the plus pressure air which the patient's mouth and nostrils are breathing in the inner chamber.

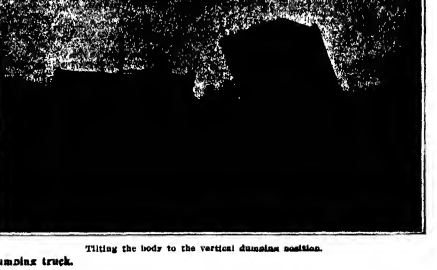
Here is one mode of fortifying the lung against collapse in intrathoracic operations; another method, that of intratracheal insufflation, may be described as follows: Ordinary breathing consists of alternating respiratory movements; aeration of the lungs therefore depends (among other factors space does not permit detailing) upon the intact condition of the chest cavity During inspiration the circumambient air reaches the smaller bronchi, where the exchange of oxygen and carbonic acid, etc., is effected in the pulmonary "air alveoli" in obedience to the physical law of the diffusion of gases. That superb scientist, Dr. Samuel J. Meltzer, discovered how "the ventilation of the alveolar air can be accomplished through a continuous stream of air passing in one direction instead of the double movements (of inspiration and expiration) in opposite directions." In making some experiments on the mechanism of breathing in the positive pressure apparatus of Brauer, Meltzer and his colleague, Auer, found that if they passed a tube through the larynx of a dog down the trachea (the windpipe) almost to the bronchial bifurcation, and blew air through this tube in a continuous stream, the animal could be kept alive for many hours, even after all voluntary respiratory movement has been paralyzed by curare. By allowing the stream of air (preferably warmed, as we shall see) to pass over the surface of ether in a bottle, they were able to anæsthetize the animals very satisfactorily; and it was possible to open both sides of the thorax widely (the lung remaining uncollapsed) and to have the animals remaining alive for any number of hours. The lungs meanwhile remained moderately distended, the heart action good and regular, and everything as good and comfortable as any self-abnegating canine might desire. The air and ether mixture was blown in at a pressure of 15 to 20 millimeters of mercury.

The only conditions essential to success were that the tube must be of a diameter less than one half that of the glottis (the upper opening of the windpipe), so that the stream of air and ether which passes

(Concluded on page 559.)



Loading the truck while it is in motion.



Tilting the body to the vertical dumping position.

The Sing Sing motor dumping truck.

Is a Forest a Storage Reservoir or a Stream Regulator?

Effect of Forest Land on Navigable Streams

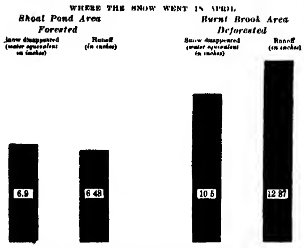
By Guy Elliott Mitchell, United States Geological Survey

THE United States Geological Survey has announced the results of an exhaustive investigation covering a period of twelve months, which disposes of a problem which has long been a source of contention among scientists as well as laymen; namely, Do forests conserve ground water supply, and do deforested areas result in greater fluctuations in stream flow? In other words, does the forest act as a storage reservoir or a stream regulator? Also, does snow disappear more quickly from deforested than from forested areas? Many scientists, including probably most foresters, and doubtless a great majority of laymen, have assumed the affirmative in all these cases. Nevertheless, there have been many people, among them engineers and other experts of eminent standing and undoubted ability, who have held to the converse—that forest cover has little effect, if any, upon stream flow and related phenomena.

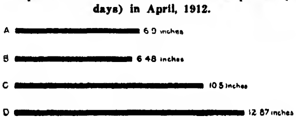
The Geological Survey, after more than a year of field investigations under the Weeks Forest Reservation Act, has finally reported on at least two distinct classes of forest lands, under which must be included a large proportion of our forests, to the effect that the forest and the forest ground cover are important factors in the regulation of stream flow.

The Weeks Act in brief provides that forest land which can be shown to exert an appreciable effect upon navigable streams may be purchased by the Government and created into forest reserves or national forests. The duty of determining this relation between the forests and the navigable streams is placed by the law upon the Geological Survey. Considered for their forestry value, lands cannot be so purchased. Such an act of government was declared by the Judiciary Committee of the House of Representatives some five years ago, to be unconstitutional. Upon the passage of the Weeks Act, therefore, appropriating $11,000,000, it devolved upon the Geological Survey to make a favorable showing on any and every tract of land prior to consideration of its purchase. The Director of the Geological Survey held that his report in each case must be based on actual field examination and the presentation of scientific data in support of his report.

The Southern Appalachian Mountain forests were first selected as presenting the most promising field, prompt action being required, since the appropriation was made in terms of fiscal years, $1,000,000 for the first year and $2,000,000 annually for the succeeding five years, these amounts, unless expended, lapsing with each July 1st. Utilizing what geological and stream flow data were available, field parties were immediately started out, and during the four remaining months of the fiscal year from the passage of the act in March, 1911, several large tracts of mountain forest land in the Southern Appalachian States were favorably reported on, based squarely upon the principle of protection of navigable streams from the products of excessive erosion due to deforestation and repeated burning of the forest mat or mulch. The silt and detritus, it was clearly shown, resulting from such forest treatment are washed down into the tributaries and from them find their way into the lower navigable rivers and clog them.



Comparison of two areas for three storm periods (17 days) in April, 1912.



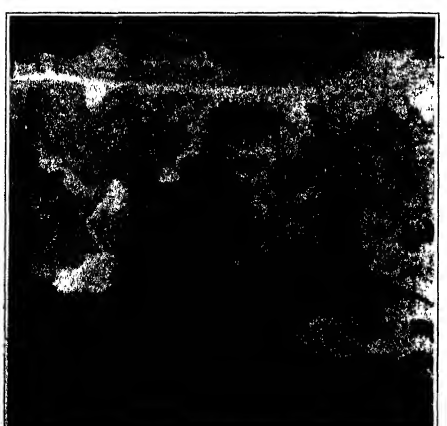
A. Amount of snow disappeared, expressed in water equivalent, during three storms in April, 1912, on the forested Shoal Pond area. B. Runoff of Shoal Pond Brook same periods and same area. C. Similar snow disappearance on the deforested Burnt Brook area. D. Runoff of Burnt Brook, same periods and same area.

In the White Mountain region, however, physical conditions were found to be different. Geologic investigation could find no basis for the statement that deforestation of the granite slopes of the White Mountains would endanger the navigability of the Merrimac, the Kennebec, or the other navigable rivers of New England. Geological Survey officials along with the majority of conservationists and nature lovers might believe that the protection of the White Mountain forests would steady the flow of the streams rising therein, but they could state their belief only as a matter of opinion. This was not sufficient under the law. If its provisions were to be carried out both in the interests of the proper expenditure of the Government money which it appropriated, as well as with a view to considering even this large appropriation as only the beginning of a broad governmental policy for the acquirement of great tracts of land in all parts of the United States where navigable rivers head, there could be but one method of procedure to show beyond question a direct and important relationship between forest cover and stream flow.

Failing, therefore, to find any excessive erosion in the White Mountains, due to deforestation, the Survey instituted hydrometric investigations in an endeavor to show that deforestation, and subsequent burning of the vegetal forest mulch, does result in a more rapid runoff, and therefore tends to make unstable the flow of streams. In this it has been successful even beyond expectations.

The hydrometric showing presented in the Survey's preliminary report is of results on two small, almost exactly similar, drainage basins on the east branch of the Pemigewasset River of about 5 square miles each, one largely clothed with virgin timber and the other deforested and burned, and is so striking as to render the position of the Survey impregnable. Careful measurements of precipitation over the areas and of the runoff of the respective streams show that not only was the snow held better in the forested area, but that during a period of 17 days in April, 1912, including three extended storms, the runoff in the stream in the deforested area was a comparative flood—practically double that of the stream flowing through the forested area. In Shoal Pond basin (the forested area) the Survey had established seven rain gages and twenty snow gages, the engineers visiting these continually during the winter on snow shoes, the snow being from 4 to 7 feet deep. In the adjoining Burnt Brook basin (the deforested area) it established nine rain gages and eighteen snow gages. On both streams hydrometric stations were established and the stream flows determined with a high degree of accuracy. The stream discharge from the deforested basin was double that from the forested basin, and the maximum flood from the forested basin was only 67 per cent of that from the deforested basin.

During the period of these storms, Burnt Brook (deforested) is shown by the report to have contributed a much greater volume of water to the Pemigewasset



Typical method of ice measurement in the White Mountains. The results of the present actual measurements in the drainage basins of this district, so accurate and refined in method as to approach laboratory experiments where exact effects may be expected, leave no doubt as to regulating stream flow.

One of forty observation stations visited weekly during winter for determining depth of snow and its water equivalent, the latter being found by weighing a sample of snow. Four observers were kept busy on this work in snow up to 7 feet deep, often in high winds and below zero.

River than did Shoal Pond Brook (forested). "The stream of the forested basin is observed to be the steadier of the two, and in proportion to its drainage area it tends—at least during the spring months—to promote a steady flow of water in the master stream of which it is a tributary."

The conclusions of Director George Otis Smith of the Survey are as follows:

"The comparison between two adjacent basins during critical periods is presented in this preliminary statement as a sufficient showing for the purposes of the National Forest Reservation Commission. While data covering longer periods for both these and other basins in the White Mountains have been collected and will be available for the more complete report, the particular case of the Burnt Brook and Shoal Pond basins is typical for the region and establishes the general conclusion that a direct relation exists between forest cover and stream regulation.

"The results of the Burnt Brook-Shoal Pond Brook studies are held to show that throughout the White Mountains the removal of forest growth must be expected to decrease the natural steadiness of dependent streams during the spring months at least. The foregoing conclusion forms a strong basis for arguing the desirability of painstaking methods of administration in respect to forest lands in the White Mountain region. Deforestation followed by fires, as in the Burnt Brook basin, results in conditions unfavorable to natural spring storage because conducive to rapid snow melting and stream runoff. Control of White Mountain lands that would reduce fires to a minimum and promote normal reforestation must result in a great improvement over present tendencies, and this improvement in forest cover can logically be expected to favorably affect stream regulation to the extent quantitatively indicated in the comparison of the forested Shoal Pond Brook with the deforested Burnt Brook.

"While the intensive hydrometric work was confined to a few headwater tributaries of the Connecticut and Merrimac rivers, the basins studied were selected as typical for the whole White Mountain area, and the field examinations over this region have shown the tracts now under consideration for purchase to be similar to the basins here reported upon. Therefore, the favorable showing of this report is of general application in the White Mountain area."

Such an actual demonstration and quantitative measure of the performance of different areas, some forested and others deforested, has never been attempted in trying to determine the effect of forest cover on stream flow. Efforts to arrive at definite conclusions have always been attempted on a basis of a study of long-time records of precipitation and stream discharge; but owing to the many qualifying factors, these have simply resulted in divergent opinions and inconclusive [illegible] no doubt as to the conclusion. Forest cover and the resulting forest mat in the White Mountain area does, to a considerable and measurable degree, steady and equalize stream flow, and therefore must be stated as an important factor in maintaining the navigability of streams whose headwaters lie in such regions.

While the report made by the Survey refers specifically to two small drainage basins, and while the conclusions reached are that the entire White Mountain area is subject to purchase under the Weeks law, nevertheless a large amount of additional work has been carried on in the White Mountains and many additional basins and areas investigated and the results recorded. In fact, the work is not even yet quite completed. As soon as finished, a final report will be made to the Commission, and at the same time a Survey bulletin will be issued which will present the facts in full and also discuss the problem from a scientific standpoint. It is believed that this will establish a fact which has been accepted, believed, and advocated by many prominent men for many years, yet which upon the challenge of equally eminent men, they have never been able to prove.

The Military Supremacy of the Air—I

The Aeronautic Plans of Great Military Powers

By Theodore M. R. von Kéler

A STRUGGLE has begun on the European continent for the military control of the air. No longer a phantasy of the novelist, or a dream of the inventor, the fight for mastery is being waged under the very eyes of wondering Europe. The two combatants, needless to say, are France and Germany; and how far this struggle already has been carried, how many millions of dollars it already has cost, and will cost in the near future, this article will show.

The German Reichstag, in the last week of May, 1912, passed by an overwhelming majority the army and navy bill, with its provision of $30,000,000 for "extraordinary expenses." The bill contained a "rider" in the form of an appropriation of $500,000 for the development of military aeroplanes. Small as this appropriation is, it served to electrify France and stir its military leaders into extraordinary activity. The very fact that the methodical, slow Teuton considered it necessary, or at least worth while, to set aside half a million dollars for the "development of aeroplanes," in addition to maintaining huge airships of the Parseval and Zeppelin types, showed more than anything else Germany's determination not to permit France to enjoy any longer its hitherto unchallenged supremacy in aerial navigation.

Other nations were not slow in recognizing the probability of having to fight at least part of their battles in the air, and a feverish activity in the launching of fighting air craft became evident soon after the publication of the French and German budgets. Early this summer the international aerial fleet, exclusive of heavier-than-air machines, consisted of sixty-five "cruisers." Of these, Germany owned twenty; France, sixteen; Russia, nine; Italy, seven; Austria, four; Great Britain, three; Belgium and Japan, each two; and Holland and Spain, each one. Five of the twenty air-cruisers under the German flag are of the rigid type, six are semi-rigid and nine are non-rigid. Aside from these the Kaiser's government has in course of construction two additional rigid airships (Zeppelin type), three semi-rigid of three different types and one non-rigid (Parseval type).

A comparison of the sizes of the various airships in the international fleet shows that the smallest is the "Dundigt" of Holland, which has a capacity of 950 cubic meters of gas; while the largest is the German "S.-L. I." (Schütte-Lanz), which is of 19,500 cubic meters capacity, and which has a lifting power of 22,000 kilogrammes. The Zeppelins are by far the fastest aerial cruisers, possessing a speed of seventy-five feet per second, while the fastest French ships so far have only been able to make fifty-two feet per second, long-distance flights in each case being figured as a basis for the calculation. The new German naval Zeppelin, too, holds the endurance record of over 31 hours in the air, during the course of which it covered 1,200 miles and broke the record of the "Adjutant Reau" of 21 hours, 21 minutes and 569¾ miles, made a year ago.

Early this spring the French Ministry of War asked Parliament for 18,116,540 francs for aerial navigation. Enormous as this sum appears, it was soon discovered that it was entirely inadequate for the needs of France. Instead of curtailing the minister's demands, the Senate suggested a considerable increase in the "aerial" programme, and a total of 33,231,350 francs was granted for this purpose. In addition, the Ministry of War obtained permission to extend its programme and its demands. The new French law reorganizing the "Fifth Arm" went into effect on March 25th.

Aerial navigation being so little understood and developed at present, it is but natural that no definite rules and regulations worked out into the minutest details have as yet been adopted. The new law is merely a combination of the chief fundamental principles underlying this sort of service. Its most important effect is the segregating of the aerial troops from the railway and engineering corps, as well as from the artillery regiments, with which they heretofore have been combined. The entire organization will be under the command of an inspector of aeronautics, who is directly responsible to the Minister of War.

Military aeronautics, according to this new French law, comprises not only flying in its ordinary sense, but also the study, construction, purchase and operation of spherical, elongated and dirigible balloons, observation kites, aeroplanes and hydro-aeroplanes, and the instruction and mobilization of aviators, aeronauts and observers. The law distinctly provides for the purchase of all military aeroplanes, etc., from private manufacturers in the open market, but permits of all repairs being made in the government shops. The idea, of course, is that private competition in such a new field as aeroplane manufacture brings better results than government work along established lines. Repairs, on the other hand, can be carried out more advantageously in the government shops, where labor is almost free and where expert mechanics are at all times available.

The new French "Fifth Arm" is organized as follows:

Seven companies (each of 3 officers and 108 men) and one transportation company (consisting of 3 officers, 127 men and 133 horses) form the aerial regiments. In addition there are 10 "sections" of 60 men each, which will take care of the actual flying. A separate staff of mechanics is to be selected from the best soldiers to carry out the necessary repairs and to work out improvements in construction.

A provision is furthermore made for a continuous transfer of men from other arms of the service to the aerial corps, so as to diffuse the knowledge of aerial work as much as possible among the rest of the army. This precaution was thought necessary on account of the extreme danger and strenuousness of the work, which few are able to endure for more than three years.

The aerial corps is open to all persons who have graduated from the Ecole supérieure d'Aeronautique in Paris or who have obtained a pilot's license from the military authorities; furthermore, members of aero-clubs and pupils of private aviation schools, who can pass an examination as to their abilities, as well as mechanicians and workmen who have been employed in aeroplane factories, chauffeurs, etc. All these may be drafted in the regular way, as are recruits for other parts of the army.

Volunteers are welcomed from other walks of life, but all of them must pass a particularly rigid examination as to their health. Perfect eyesight, good lungs, a good knowledge of gasoline engines and wireless telegraphy are essential. Only officers will be graduated as pilots of single-seated aeroplanes, petty officers and men being restricted to the position of mechanician or pilot of aeroplanes with more than one passenger. Officers, whose duty it is to familiarize themselves with the work of the aeroplane corps, such as members of the general staff, artillery, etc., are taken on board the aeroplanes as observers.

(To be continued in next week's issue.)

THE LIST OF FRENCH DIRIGIBLES.

No	Name.	System.	Length. (meters).	Cubic Contents. (cubic meters).	Motor Power.
1	Liberté	Lebaudy	65	4,300	1 of 100 horse-power
2	Col. Renard	Astra	69	4,800	1 of 120 "
3	Capt. Marshal	Lebaudy	85	7,500	2 of 110 "
4	Le Temps	Zodiac	[illegible]	2,300	1 of 70 "
5	Adj. Vincent	Clément-Bayard	[illegible]	9,000	2 of 200 "
6	Adj. Reau	Astra	[illegible]	5,950	2 of 120 "
7	Capt. Ferber	Zodiac	76	6,000	2 of 90 "
8	Selle de Beauchamp	Lebaudy	70	6,000	2 of 75 "
9	Lt. Chaure	Astra	[illegible]	[illegible]	2 of 120 "
10	Comm. Coutelle	Zodiac	[illegible]	9,000	2 of [illegible] "
11	Gen. Meunier	Lebaudy	[illegible]	10,000	2 of [illegible] "
12	Clément-Bayard V	Clément-Bayard	[illegible]	9,000	2 of [illegible] "
13	L'Eclaireur-Conté	Astra	[illegible]	[illegible]	2 of 75 "
14	Spiess	Zodiac	104	11,000	2 of 200 "
15	Le Fleurus	(special)			
16–20	Five ships of not less than 8,000 cubic meters planned, of a type similar to Astra (No. 13)				

THE FRENCH BUDGET FOR AERIAL EQUIPMENT.

Expenses for.	Regular 1912.	Additional.	Total.
Men	977,940 francs	[illegible] francs	[illegible] francs
Aeroplanes	11,200,000 "	[illegible] "	[illegible] "
Airships	6,036,600 "	[illegible] "	[illegible]
Total	18,116,540 francs	15,114,810 francs	[illegible] francs

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Free-toll Canal Absurdity

To the Editor of the SCIENTIFIC AMERICAN:

It certainly seems strange that we Americans, after spending $400,000,000 in making the Panama Canal a reality—for within the next ten years that amount of money will have been paid out from the U. S. Treasury on account of the canal—are so simple-minded and so unbusinesslike as to allow, year after year in the future, untold millions to go into the pockets of steamship owners rather than back into our own Treasury.

It is planned that all this money that the owners of American coasting vessels should pay to the American people is to go into the pockets of these vessel owners; just so much more in dividends to divide among the stockholders.

Are we encouraging American shipping by allowing American coasting vessels free passage through the canal? Is the great and glorious American mercantile marine service to be revived and given new and endless prosperity by escaping the payment of a toll of this kind? Not a bit of it!

The men who control the various steamship lines, and others who are planning to operate new lines and make use of the canal, are all prepared and ready to pay a toll for the passage of their vessels through the canal. If it should be decided to-morrow to make all American vessels pay to pass through the canal, it would not change the plans of the existing companies, or of the individuals who are planning to enter the business in competition with existing lines, one particle. The entire trade will be in the hands of a few corporations. If they and their stockholders have to pay a toll to the American Government, as, of course, they should, it means so much less profit per annum to them, less cash to divide among the combine, but it also means that the American people have got just that same amount of money paid into the U. S. Treasury, and not into the pockets of a comparatively few already wealthy individuals.

The idea of the American nation spending $500,000,000 and letting the steamship companies cripple the earning power of the canal, and putting those tolls into their private pockets instead of benefiting the entire country by paying these sums into the U. S. Treasury, is simply monstrous! What benefit is the American nation getting by allowing millions of dollars in tolls to go into the pockets of a few millionaires? As a result of free passage through the canal, are these steamship corporations going to make a reduction in freight rates? Well, hardly. As a result of this elimination of tolls, do we hope to induce the men in the steamship business to use the canal? Are we afraid that a toll will scare them off? Is it a kind of national subsidy or encouragement for Americans to invest in the shipping business? No! Everybody who has occasion to use the canal is going to use it, toll or no toll, and the payment of a proper toll is not going to cause them to fail, or go out of business, or discourage them from building new ships. Is it supposed to be patriotism, or just pure generosity, or what in the name of reason is it, that makes certain individuals at Washington and various newspapers declare that millions of dollars that should by right be added to the national wealth every year, had better be turned over to swell the fortunes of a few individuals?

It certainly would be an edifying sight to stand on the bank of the canal and watch ship after ship, some going east and some going west, all owned by American corporations in coast trade (and manned mostly by foreigners) passing through free of expense. A good half billion dollars spent by the U. S. Government; the canal and its entrances choked with free ships; and 90,000,000 or more Americans wondering why the few corporations that own these ships should be allowed such an unjust privilege! Is that a businesslike way to run any enterprise?

How are expenses to be met? Oh, that's easy. There is plenty more money in the Treasury, and then we will soak foreign-owned ships, and Yankees as well, who have been so unfortunate as to own ships engaged in commerce with other countries. Their ships happen to be loaded with cargoes for Callao or Hong Kong instead of for San Francisco or New York, and you bet we'll make them pay for going through the canal!

Now that is logic, isn't it! The fact is, that this whole free-toll business has been engineered by powerful interests, who hope to fatten their bank accounts with the millions that rightly should go to the U. S. Treasury. England has protested, and rightly. The wording of the treaty that she calls to our attention is perfectly plain, and for any true American to try to interpret it differently is to invite suspicion and scorn from all civilized nations. To reply to England that the canal was built with American money and is ours, and that we shall do what we like with it, is childish in the extreme.

As it looks now, we shall not do as we like with it. Far from it; for the great benefit will accrue to a few corporations only. It is impossible to conceive that any such absurd proposition should continue in force very long. If this free-from-toll scheme for coasting vessels is allowed, there will be a great howl later on, when all the people begin to realize that they have been fooled. Now is the time to save ourselves from becoming more ridiculous than we already are.

During the past few years our moral perspective and sense of obligation seem to have become rather twisted and out of line; in fact, from the very beginning of this canal business; and he who has shouted himself hoarse about "fair play" and "a square deal for everybody" has publicly boasted about the part he played in buncoing Colombia out of Panama. We have refused to entertain Colombia's plea for arbitration, because we know she is a weak nation and helpless to enforce her rights. Let us hope, however, that the coming administration will acknowledge the mean trick that was played on a sister republic, and that she will receive proper reparation. Those who attempt to defend the attitude that we have taken toward Colombia give as an excuse that "we got the canal, anyway." Let me say, and everyone who understands the situation at that time will agree with me, that we would have had it just the same by adopting fair and honorable means. Let us beware how we treat England in this present dispute, for she can humiliate us, while poor Colombia cannot.

H. M. W

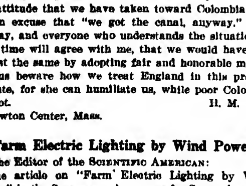
Newton Center, Mass.

Farm Electric Lighting by Wind Power

To the Editor of the SCIENTIFIC AMERICAN:

The article on "Farm Electric Lighting by Wind Power" in the SCIENTIFIC AMERICAN for September 28th is a good one. Having had a few years experience with a somewhat similar plant, perhaps it may be of interest to compare notes.

My own plant is of even smaller capacity than Mr.



A pump in the windmill power circuit. A and B commutators, and C and D field windings of dynamo.

Forest's, but that is due mainly to the expense involved. I have tried many experiments in attempting to find a satisfactory way of charging batteries; among others I have tried that of putting the batteries in series with a motor used to drive a pump, so that the windmill had to furnish power to run the pump as well as to charge the batteries at the same time. While this arrangement worked well enough to permit of charging several home-made cells for the first time—which, of course, required many hours of charging—yet the experiment of rewinding the dynamo, so as to charge the batteries without having the pump motor in circuit, was made.

The result of this change was a decided speeding up of the windmill, but on the whole it was a great improvement, as the system required less attention. Oiling is about all that is necessary.

Mr. Forest's plan of using a quarter-turn belt from windmill to dynamo looks good, as it should reduce both noise and friction. While at this season of the year there is often more power than one can satisfactorily take care of with such a plant, there are times when such improvements as a ball bearing at the foot of the vertical shaft, and a pair of universal joints near the top of that shaft to take care of the slight bend which would otherwise be made by the weight of the tail of the windmill, will show a surprising difference in the speed of the windmill.

As to using two pulleys, to allow for variations in the speed of the wind, my experience has been that at times when the wind velocity is low, and a large pulley is accordingly being used on the windmill, there is sometimes a gust of wind of short duration which is severe enough to speed the armature up and make the wires burst from the slots. Since re-winding the armature several times, I have wedged the wires in, and use only the smaller of two pulleys on the windmill. Even now the speed is at times enough to make one fear for the armature winding.

Mr. Forest's plant does not include a pump; there are some difficulties in belting a pump to a power windmill, for if geared so as to pump with efficiency in light winds, speed and noise will probably be excessive in heavy ones.

The diagram shows a method of avoiding excessive speed of a pump without cutting down its efficiency at low speeds of the windmill. After the pump reaches a certain speed, charging current passes into the batteries. Both the pump's speed and charging current are automatically limited, without the use of mechanism likely to get out of order. If the field windings C and D are of low resistance, and if automatic cutout is efficient, there will be no danger of the motor's speeding up to bursting point if the belt slips.

I have tried an experiment which leads me to think that the above scheme is as good in practice as it looks in theory. Of course, the windmill may speed up considerably in very high winds, as the load on it is limited, but it will not speed up quite so much with a heavy load as it would with a light one. Of course, if it were not for the expense, it might be better to increase the load by increasing the size of the battery. In this case, an ordinary shunt-wound motor might be used to drive the pump, current being taken from the battery.

In the article referred to, something was said about reversing the polarity of the dynamo. It would seem that this ought to be impossible; certainly some systems are such that a reverse current from the battery would only strengthen the dynamo field.

As I remember it, you published an article on German windmills for charging storage batteries some years ago. Judging from the illustrations, excessive speed was prevented by dividing the blades of the windwheel into sections, which were connected together and operated like the shutters of a window blind. Presumably, when the speed reached a certain limit, centrifugal force caused the "shutters" to open and let the wind pass through. Just how satisfactorily this worked was not stated; if no better than some other windmills, the windmill would stop entirely after the automatic speed limit came into play. Then it would gradually speed up to a considerable speed, then stop entirely, etc.

EDWARD A. FINCH.

Sound Beach, Conn.

The Gift to the City of Evansville

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 7th, page 480, under heading of "A Curious Gift to the City of Evansville," there is a typographical error that might cause some confusion. It is stated that $1,000 placed at 4 per cent interest per annum, compounded semi-annually, in 250 years would aggregate $90,956,400 13. It should be $19,956,400 13. The calculations in this transaction were made by Mr. C. L. Delbridge, the St. Louis mathematician, for the parties to this contract. I have talked with him many times about it, and herewith inclose a booklet in regard to same, issued by the company for whom he is the official mathematician, in which the amount is given as $19,956,400 13.

St. Louis, Mo. W. F. COLLINS.

Landing Aeroplanes from Warships

To the Editor of the SCIENTIFIC AMERICAN:

The daily papers of November 13th, 1912, describe a successful test of a launcher for flying machines which took place at the Washington navy yard on the 12th.

All who are interested in the improvement of the aeroplane may well congratulate themselves that the subject of launching, which has so far received comparatively little attention, is now coming to the front.

It is now recognized by the authorities that, if the aeroplane is to be used for naval scouting, it must be able to take flight not only from the water but also, under some conditions, from the very restricted area which can be spared on a ship's deck.

Various forms of launchers have been invented. The first successfully used was the "tower, weight and tackle," familiar to all who witnessed the earlier flights of the Wrights.

Among other inventions are launchers using (a) the energy of compressed air, (b) atmospheric pressure acting in a vacuum tube, and (c) an endless cable which is a much abbreviated form of the cable formerly used on street railways.

From what has been written upon the subject by the naval authorities, it may be gathered that, in a launching apparatus, the navy needs one which will in no way be a nuisance when a ship is in action. The number of parts should be as few as possible, the apparatus must be one which can be quickly taken apart and stowed in a small compass.

It seems probable that as time goes on, naval architects will be working in co-operation with the inventors of aviation apparatus. When it is considered that in the modern ship of war nearly every space is already utilized, it would seem that in moments of stress any aviation apparatus may prove to be an intruder.

If it be the opinion of naval architects that in a battle or in the preparation for battle, when the order comes to "Clear decks for action" aviation apparatus will be a nuisance, it will be a gain if they will say so. That will hasten the time when one of our older ships of moderate size may be devoted exclusively to aviation, serving as a parent ship for aeroplanes.

JAMES MEANS

Boston, Mass.

Aquatic Life in Its Own Setting

A New and Fascinating Territory Opened to Nature-students

L'Illustration

Otter returning to the surface with its prey

L'Illustration.

The same otter in pursuit.

APPARATUS like those devised by Dr Francis Ward an English student of zoölogy suggests some quaint reflections on the methods which mankind has been following for countless generations in studying the appearance and movement of fishes and aquatic animals It is almost as if we had been forming conclusions on the shape color and movements of horses or of sheep solely upon our observation of the drowned corpses of such quadrupeds. A fish out of water is not himself no matter if he be still gasping on the bank freshly hooked his color for reasons which Dr Ward lucidly explains is a constantly varying function of his immediate surroundings the pose of his fins can never be the same out of water as it is under hydrostatic pressure and all this is over and above the difference between the study of things alive and dead in their own habitat and in captivity—the difference which has made the contemporary sport of hunting with the camera such a valuable aid to biological study

For the aquatic form of camera sport, it was first necessary that a highly specialised apparatus should be constructed First, Dr Ward had a pond made, in which he arranged, for the subject of his study conditions exactly like those to which they would be accustomed in any piece of water where they might naturally be found. But all the sides of this pond are built of concrete and in one wall, as he describes it in his Marvels of Fish Life as Revealed by the Camera (Cassell & Co Limited) is an observation chamber separated from the water by plate glass Concealed in the chamber the observer can watch the fish as they appear to each other in the water In consequence of the darkness in the chamber and the light in the pond the glass is converted into a mirror and the fish merely sees himself and his surroundings reflected, while the observer can plainly see into the pond It is thus possible to observe a timid fish without disturbing him The light by which the fish are seen is of course, that which penetrates from the surface of the pond and this illumination, at least so far as three feet below the surface is sufficient to enable the concealed observer to take instantaneous photographs of the totally unsuspecting creatures as they live their own mysterious lives in their own environment.

Some of the results obtained will be startling to persons of only ordinary information on the subject. For instance fishes are generally supposed to be creatures devoid of emotion or at least very undemonstrative but the frontispiece of Wonders of Fish Life an exquisite bit of color photography shows a perch paling with fear This particular study was the climax of a fish drama (more really satisfying than the old fashioned tank drama) which Dr Ward watched from his place of concealment the perch had audaciously swallowed a worm on which a great big rainbow trout had his eye the trout had seen him do it and the perch had just found out that the trout had seen—hence the pallor Then Dr Ward tells some interesting things of a pike which he photographed through a series of emotional moments. At one of these moments the pike rests motionless on the bottom, with his body just off the ground supported on his fins. That the pike is on the watch all the time is evident from the keen look in his eye Suddenly without any movement of the body or other fins the fin on the back will become erect and fully extended, a sure sign of mental agitation This is when he catches sight of his prey, a dace. The third dramatic moment is when he is on the point of charging down on the dace, and lastly we are shown 'a disgusted and disappointed fish when the dace has disappeared

Perhaps of more definite importance in a scientific sense if only because more clearly demonstrable, are the facts brought out by Dr Ward as to the defensive coloring of fishes. Some of the illustrations given in Marvels of Fish Life" are not only convincing evidence of the aid to concealment afforded the weaker species by the peculiar reflecting power of their skins, but also testify to the effective working of photography in the special circumstances of Dr Ward's observation pond To exhibit the various effects of light on the fishes bodies, the investigator has also used an

L'Illustration

Arrangement of observation chambers designed for a Honolulu hotel.

Contrivance for photographing with the operator above when the water is disturbed

Photographing fish in tank with light from two sides.

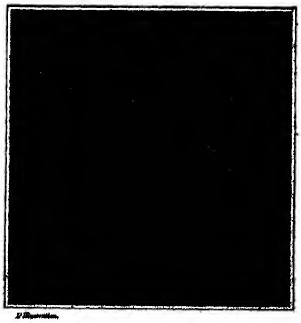
From Marvels of Fish Life (Cassell & Co)

Dr Ward's pond before filling showing observation chamber

Dace, showing its dark back, silvery side and white under-surface. As depicted in books.

L'Illustration

Gull at rest on the surface



L'Illustration.

As the fishes see a gull entering the water—fish swimming straight down.

apparatus for taking photographs of his subjects in aquarium tanks with light admitted only from the front side. With this apparatus and an arrangement of stick sticks placed in the tank, and over which a fish was cleverly induced to pause for a moment, a very good demonstration has been obtained of the wonderful effect of the numerous "mother-of-pearl-like spicules" in the deep layers of the skin, which make this fish a perfect living and swimming mirror.

Then, to investigate the ways of fishes which inhabit waters outside of Dr. Ward's private pond, and far from its observation chamber, he has contrived a very ingenious portable apparatus which is here described in his own words: "When using the camera above the surface of the water, it is necessary to use some form of apparatus which cuts off the light from above (to prevent blurring of the plate during exposure by the stronger light on the surface). With this object I use three different contrivances: (1) A light wooden frame, six feet by four, over which is stretched a sheet of dark-colored canvas; (2) a large golf umbrella; and (3) a special apparatus on the principle of a sea telescope." The last-named of these three devices (shown in the illustration) is used when the surface of the water is ruffled. "It consists of a box three feet long and one foot square, fitted with a ¼-plate reflex camera. The camera slides up and down inside the tube, and can be fixed at any point." One very striking photograph obtained by this method shows how a plaice (or flounder) makes itself safely inconspicuous in the mud at the bottom.

But more startling and enlightening photographs of aquatic life obtained by Dr. Ward are those for which he had to go elsewhere than his little observation pond. These, which were also obtained by means of subaqueous photography, have been published since the appearance of "Marvels of Fish Life." Three sets of these marvelous studies of nature are here reproduced from *L'Illustration*. They are studies respectively of an otter, a gull and a penguin. First comes the otter, as any terrified fish might see him, the air bubbles streaming away in his wake, as he noses about among the rocks, seeking what he may devour. There can be no question about the wickedly predatory expression of that head and neck. Next, he is seen in rapid pursuit of his quarry; and the camera informs us that he uses only his two hind legs in swimming. Lastly, he is shown nearing the surface (seen from below, of course) after a successful raid, with a fish in his mouth to be enjoyed at leisure after landing. The gull is shown in one picture much as men are accustomed to see him, borne on the rippling waves, and busy wondering where the best fish may be had with the least trouble: the next picture shows him as probably no human being ever saw a gull; he has just pierced the surface, and the agonized little fish on the right of the picture is swimming for dear life by the shortest way to the bottom. The penguin in the two photographs reproduced here, shows of how little use legs are to his kind: he walks very little on shore and uses only his wings for swimming. This also explains the mystery of the penguin's wings, with which he never flies.

Subaqueous photographs of vertebrates are not all the illustrations of Dr. Ward's "Marvels." There are numerous beautiful illustrations of molluscs and tiny crustacea. Some of the photographs of fish larvæ in various stages of development are fine examples of aquatic micro-photography, and the author gives an illustration of a micro-photographic apparatus of his own contrivance, by means of which "it is possible single-handed to take photographs of living objects in a vertical or horizontal position by daylight or by artificial illumination." This apparatus, which photographs up to a magnification of 2,700, can be used by any photographer for an object which has first been posed on the stage by an expert biologist. The photographer watches, by means of a mirror, the changing positions of, say, the young fish in the cell, and makes the exposure at the opportune moment.

A drawing of two observation chambers for submarine life, reproduced here from *L'Illustration*, shows the latest attraction provided by a Honolulu hotel for visitors interested in the wonders of Pacific nature. The visitors will descend by a flight of stairs into one or other of these novel showrooms and watch the movements of such Hawaiian fauna as may choose to disport themselves for their amusement and instruction in the immediately adjacent waters.

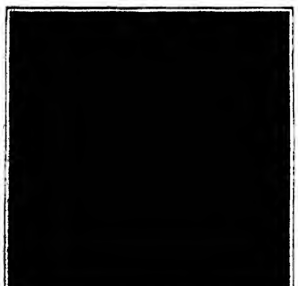
L'Illustration.

Otter exploring for fish. As seen under water.

Dr. Ward's apparatus for vertical or horizontal micro-photography of live objects.

L'Illustration.

Penguin swimming under water.



L'Illustration.

Penguin coming to the surface—head and neck already above water.

New Berlin Electric Traction System

THE recent decision of the Government regarding the electrification of the whole suburban traction system of Berlin is an interesting one, and is in line with similar plans made for London, Paris, and other large cities. The present critical situation of Berlin transport led to the adoption of the new measure by which the suburban lines will be modernized in the period before 1916. A remarkable growth of population, as M. G. Richard states, is seen in the case of Berlin. From 1895 to 1909, or the last census, that is in fourteen years, the population increased from 2,017,000 to 2,898,000. For the suburbs the increase is from 382,000 to 807,000, so that the population of Berlin and its suburbs reached 3,705,000 in 1909. As to the traffic on the Metropolitan, this was 75,000 in 1895 and 157,000 in 1909, and the suburban traffic shows 41 and 137 millions, respectively. On Sundays the traffic to the suburbs is as high as 341,000 to 794,000. After failing to secure a solution by the use of steam, it was decided to adopt electric traction on the whole of the lines. Then came the question of electric locomotives vs. motor cars, and it was found best to use locomotives, as these have some advantages. Each one replaces several motor cars, and very heavy trains can be drawn by coupling several locomotives together. Because the power machinery is larger the upkeep is less difficult, and the parts are easier of access. Besides, the yield in power is higher in the case of the locomotive. The motors are well suspended by springs, and the passengers are less subjected to shocks than with motor cars. One point is that a great part of the old passenger cars can still be used. For heavy traffic hours, 13-car trains are used and two locomotives take the trains, one in front and one at the rear. Such locomotives work on single-phase alternating current with 15,000 volts on a trolley wire such as is in use in the suburbs of Hamburg and on the Dessau-Bitterfeld line. Current will be furnished by two 150,000 horse-power electric plants, one to be erected at 80 miles from Berlin, near the Bitterfeld coal mines, and from here the current will come over a 60,000-volt power line, using for this purpose six pairs of underground cables. The second electric plant will be at Berlin. The cost of the stations and cables is figured at $22,000,000, and these plants will be erected by a company with which a 30 years' contract will be made, as the Prussian Government considers that it is preferable not to have the State itself engaged in operating electric plants. Counting the central stations and substations along the roads, the overhead trolley wires, feeders, as well as the rolling stock electrically equipped, including 557 locomotives, 690 new cars, and 29 cars for repairs or upkeep, the total cost is estimated at $32,000,000, and it is proposed to complete the whole of this great enterprise in four and one half years.

England's Greatest Rainstorm

ON August 26th and 27th, 1912, a serious disaster overtook the fine farming lands of East Anglia (the counties of Norfolk and Suffolk, in England), in the shape of a fall of rain that was without precedent in the British Isles. The catastrophe to agricultural interests was aggravated by the fact that harvesting had been delayed by inclement weather earlier in the month; the deluge carried away the grain that had been cut but not brought in, as well as destroying what remained uncut Forty-two bridges were carried away by the flooded rivers, and an immense amount of other damage was done.

Although the spectacular features of this storm were recorded in the daily papers at the time, it has required some months for the collection of exact statistics of the rainfall. These have now been gathered, tabulated and charted by Dr. H. R. Mill, director of the British Rainfall Organization, who announces that the greatest long-continued widespread rain previously recorded in any part of the British Isles produced only half the volume of the East Anglian fall. In fact, only two instances could be found—July, 1875, and November, 1878—in which the rainfall of a *whole month* exceeded that of the 24 hours during which the recent storm continued.

While for scientific purposes rainfall is always reported in inches, to the layman such measurements are decidedly less impressive than statements as to the actual volume or weight of the rain. It may, therefore, be interesting to record that during the brief storm in question 150,242 million gallons of water fell in the county of Norfolk alone, the weight of which was 670,720,000 tons. This is more than twice as much water as is contained in Windermere, the largest of the English lakes.

An interesting local industry affected by the storm was canary raising, which is extensively carried on at Norwich. The birds are raised for the most part by workingmen, who keep the cages in sheds in their gardens. These were the first to be flooded, and as the highest concern was the saving of human life, no attempt could be made to move the cages. It is said that at least one particular strain of Norwich canary has been wiped out.

A Novel Aeroplane Propeller.—Spencer Heath of Washington, D. C., has patented, No. 1,043,830, a propeller formed from a blank of sheet material which is folded longitudinally to produce a number of thicknesses to form reinforcements and give the necessary strength to the blades.

The Heavens in January, 1913

Is Venus a Dead or a Living World?

By Henry Norris Russell, Ph.D., Professor of Astronomy in Princeton University

ONE of the most interesting objects for the amateur observer at the beginning of this new year is the planet Venus, which is now well placed in the western sky, setting between 8:30 and 9 P. M. With the telescope she appears like the Moon about one day after her first quarter, and with a magnifying power of 100 looks almost exactly the size that the Moon does to the unaided eye. The novice at the telescope will hardly believe this, for the inexperienced eye in looking at an object in the circumscribed field of a telescope unconsciously focuses itself as if on a neighboring object, quite differently from the way in which it adjusts itself to view the Moon in the open sky, and this unconsciously affects our judgment of the apparent size of the planet, as seen in the telescope. If the Moon can be seen in the open sky with one eye, and Venus through the telescope with the other, the true relation of the two images is apparent.

Though Venus is one of the most satisfactory objects on a first telescopic view to a beginner, she is one of the most aggravating to an experienced observer, for her brilliant surface obstinately refuses to show any definite markings by which we might hope to find in what period her rotation took place, or what was the inclination of her axis. Faint, ill-defined, fugitive shadings have occasionally been noticed, but they cannot be recognized on later nights, and leave us no wiser on the matters which we might wish to know.

That the planet's rotation is slow is however proved by two lines of evidence. First, when she is nearest us, and, in particular, when she passes between us and the Sun, as in 1874 and 1882, her diameter can be measured with great precision, and it has been found that her surface is practically spherical. We know that the Earth's rotation causes it to bulge at the equator, so that the polar diameter is 26 miles shorter than the equatorial. An equally great oblateness of Venus would have been very clearly revealed by such measures as have been described; and if the amount had been even one third as great, it would have been capable of detection. But to get one third of the flattening in the case of the Earth the period of rotation would have to be increased from one day to nine. Conditions on Venus are in this respect very similar; and we can conclude that if the rotation period of Venus was much less than ten of our days, the flattening at her poles could hardly have escaped detection, unless, indeed, her axis was very highly inclined to the plane of her orbit, and at the time of transit we looked almost squarely down on one of her poles, which seems decidedly improbable.

Another searching test was made some years ago at the Lowell Observatory, when Dr. Lowell and Mr. Slipher attacked the problem with the aid of the spectroscope. If the spectrum of the planet is photographed in such a way that the light which forms one side of the strip of spectrum comes from one limb of the planet, and that on the opposite side from the other, and if the planet is in rotation, so that one limb is approaching us and the other receding, the lines in the spectrum will be shifted, in accordance with the well known principle, to the violet on one side of the spectrum and to the red on the other, so that they run across it obliquely, and not at right angles. From measures of this slant the rate of motion of the planet's equator, and hence the period of rotation, may be computed.

This method was tested with very satisfactory results on Mars, Jupiter and Saturn, giving values for the rotation period very close to those already known to be correct. In more recent time it has given astronomy its first definite knowledge of the rotation period of Uranus. But when applied to Venus it gave negative results. The lines in the spectrum ran squarely across it, and the most careful measurements, made with all precautions, showed that if there was any tilt at all, and hence any rotation of Venus, the tilt must be excessively small, and the rotation very slow. Anything much faster than one turn per month could probably have been detected.

Here the matter rests at present so far as observational evidence goes. Dr. Lowell believes that, as in the case of Mercury, Venus keeps always the same side toward the Sun, rotating once in 225 days, the period of her orbital revolution. An alternative theory, equally consistent with the observations, has been proposed by an English meteorologist, Mr. Clayden. The surface of Venus is so white, and reflects so large a proportion of the sunlight which falls on it, that we are almost shut up to supposing that it is composed either of snow or clouds. As the Sun's heat would be twice as great on Venus as here, permanent snow all over the planet is out of the question; clouds remain as the only alternative. These may be, as Dr. Lowell thinks, clouds of dust stirred up by the violent winds which sweep over the planet's surface from its desert but eternally sunlit side to the cold, dark hemisphere of night, where the oceans of the planet—if ever it had any—are piled up in mountains of ice.

Mr. Clayden, on the other hand, assumes the clouds to be ordinary clouds of water vapor. If the planet rotated as fast as the Earth, these would presumably arrange themselves, as on our own planet, in patches and masses, denser in some latitudes than others, but with clear spaces between. If the planet always turned the same side to the Sun, clouds of the sort we are now considering could hardly exist at all on its sunward side. But, according to Mr. Clayden, if the period of rotation was several weeks in length, the atmospheric circulation would depend directly on the planet's rotation, and it would be quite possible for the side toward the Sun to be permanently cloudy, with perhaps regions of broken cloud here and there, varying from time to time, which would explain the faint markings sometimes seen.

We have thus two pictures of conditions on our sister planet between which to choose, both of which are consistent with the known facts of science. One is of a dead world with one side a desert, hotter and more arid than any in Arabia or Arizona, under the blinding glare of never-ending sunshine twice as hot as ours and swept by dust-laden hurricanes, while the other side is swathed in endless night, and cold beyond the keenest frosts of our polar winters. The other shows us a world which may be as much like our own in surface as it undoubtedly is in size and mass, with an atmosphere and oceans, rotating far more slowly than the Earth, but yet so that the intervals of continuous light or darkness are not as long as in our own Arctic or Antarctic lands, with a sky covered always with clouds dense enough to reflect away into space the dazzling beams of the Sun, leaving below them perhaps no more light, and no excess of heat above what we ourselves are familiar with; a world, in short, which might be perfectly fitted to be the abode of life such as exists on our own Earth. Between the two in our present knowledge the imagination may choose, tantalized perhaps by the thought that if the second hypothesis be true, the true surface of this world so much like our own is forever hidden from us by the cloudy veil that protects it from the heat of too neighboring a Sun.

The Heavens.

Our map shows what may be seen in the evening skies as these would appear to a man lying flat on his back and gazing at the whole vault of heaven at once.

Right overhead and southward to the horizon is the finest region of all the starry sky, stretching from Gemini, Taurus, and Auriga past the two Dog Stars and Orion into Argo, whose great star Canopus can be seen low in the south from all latitudes south of Virginia.

Eridanus, Cetus, and Pisces fill the dull southwestern sky. Aries, Perseus and Andromeda are in the northwest; Cassiopeia, Cepheus, Draco, and Ursa Minor in the north; Ursa Major in the northeast; and Leo and Hydra in the east.

At 11 o'clock: Jan. 7.
At 10½ o'clock: Jan. 14.
At 10 o'clock: Jan. 22.
At 9½ o'clock: January 29
At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

NIGHT SKY: JANUARY AND FEBRUARY.

The Planets.

Mercury is morning star this month, rising about 5:50 A. M. on the 1st, and being visible in the dawn, while later on he draws nearer to the Sun and is not observable.

Venus is a splendid evening star, as already described.

Mars is morning star in Scorpio and Sagittarius, rising early in the month at about the same time as Mercury, with whom he is in conjunction on the 9th, but remaining in sight after the latter vanishes from the morning sky.

Jupiter is also a morning star, rising about 6 A. M. in the middle of the month. On the 11th he is in conjunction with Mercury, and on the 13th with Mars. All three planets are then within a few degrees of one another, but not conveniently placed for observation.

Saturn is in Taurus and is well observable, coming to the meridian at 9 P. M. on the 1st and at 7 P. M. on the 31st.

Uranus is in conjunction with the Sun on the 23rd, and is invisible.

Neptune is in Gemini, and comes to opposition on the 14th. He may easily be found (with a telescope) by means of the map published last month.

The Moon is new at 5 A. M. on the 7th, in her first quarter at 11 A. M. on the 15th, full at 11 A. M. on the 22nd, and in her last quarter at 2 A. M. on the 29th. She is nearest the Earth on the 23rd, and farthest away on the 11th. As she moves around the skies she passes through conjunction with Mercury, Mars and Jupiter on the 5th, Uranus on the 8th, Venus on the morning of the 11th, Saturn on that of the 18th, and Neptune on the 21st—none of the observable conjunctions being close.

To Our Subscribers

WE are at the close of another year—the sixty-eighth of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

The British Association for the Advancement of Science will hold its next meeting at Birmingham, beginning September 10th, 1913.

Edward Charles Pickering

By Marcus Benjamin, Ph.D.

THIS year the American Association for the Advancement of Science will meet in Cleveland, Ohio, to which place it returns after an absence of twenty-four years. The presiding officer of the meeting will be Edward Charles Pickering, the most eminent of living astronomers in the United States.

Prof. Pickering was born in Boston, Mass., on July 19th, 1846. He is the son of Edward P. and Charlotte Hammond Pickering. His ancestry on his father's side goes back to John Pickering, who came from England and settled in Salem in 1642, and includes among other distinguished persons famous in the history of our country, Col. Timothy Pickering, who after service under Washington in the field became Postmaster General, then Secretary of War, and finally Secretary of State during the administrations of Washington and Adams.

Young Pickering was educated at the famous Boston Latin School, and then passed to the Lawrence Scientific School of Harvard, where he was graduated in 1865 with the degree of B.S., having taken the course in civil engineering.

His ability had been so evident during his undergraduate years that he was at once made an instructor in mathematics in the Lawrence School, but his stay was short; for in 1868 he was called to fill the Thayer chair of physics in the then recently organized Massachusetts Institute of Technology, where he remained for nine years. During this period he organized the first working laboratory in physics in the United States and the methods inaugurated by him have since been adopted elsewhere. In connection with his work he prepared the volume on "Physical Manipulation" (1874), a text-book that has received high commendation and is still universally esteemed.

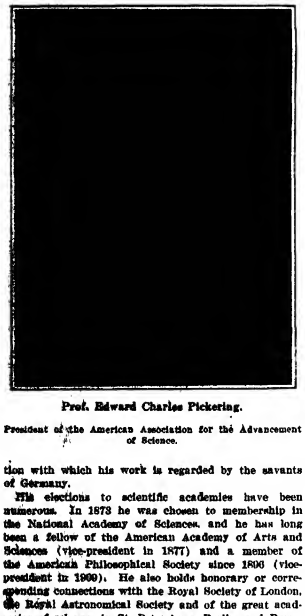
In 1876, soon after the death of Prof. Joseph Winlock, he was called to the chair of Geodesy and Astronomy in Harvard with the directorship of the great observatory there, which place he has since held.

With his extraordinary zeal for investigation and at his disposal a splendid instrument of 24-inch aperture, the lens of which was ground by Clark, Prof. Pickering at once began those special studies that have gained for him and the Harvard Observatory so much renown. These studies have been largely devoted to examination of the light and spectra of the stars for the purpose of determining their brightness. For this object he devised a mechanical meridian photometer with which he has made over a million and a half measurements of the light of the stars. The details of this work were given in a catalogue entitled "Harvard Photometry," in which he gives the magnitude of over 4,000 stars, and in a later publication similar measurements of more than 21,000 stars are given. He measured Jupiter's satellites while they were undergoing eclipse from 1878 to 1891, as well as the satellites of Mars and other faint objects. Subsequent to the death of Henry Draper he began the application of photography to astronomy and in a memorial to his friend he undertook an investigation of the spectra of the stars by photography on a scale greater than ever before attempted, resulting in the publication of an elaborate memoir dedicated to the memory of his colleague.

In consequence of a fund of $250,000 left by Uriah A. Boyden to the observatory for the special purpose of studying the stars at high altitudes, he established, in 1890, an observing station at Arequipa, Peru, and there his brother, William H. Pickering, observed the stars of the southern heavens, thus extending the work that had been begun in Cambridge, until photographic charts of the entire heavens from pole to pole have been made. These and other studies of the work accomplished under his direction have for the most part been published in the "Annals" of the Harvard Observatory of which nearly one hundred quarto volumes have been given to the world, and of these more than one half have been issued under his editorship since he became director.

His other scientific activities, and they have been many, included services as a member of the U. S. Nautical Almanac Expedition sent to Mount Pleasant, Iowa, to observe the total eclipse of the sun on August 7th, 1869, and he was also a member of the party sent by the U. S. Coast Survey for a similar purpose to Xeres, Spain, in December, 1870. The subjects of mountain surveying, the height and velocity of clouds have attracted his attention, and he did much toward the organization of the Appalachian Mountain Club of which he was the first president in 1877, and again served that club in a like capacity in 1882.

His many services to science have not passed without recognition. He received the Henry Draper gold medal from the National Academy of Sciences in 1877. The Royal Astronomical Society of London gave him a gold medal in 1886 for his photographic researches, and again in 1901 for his studies on variable stars. He received the Rumford medals in 1891 and the Bruce medal from the Astronomical Society of the Pacific in 1908. His own Harvard in 1903, California in 1886, Michigan in 1887, Chicago in 1901, and Pennsylvania in 1906, have conferred the degree of LL.D. upon him, while Victoria gave him a Sc.D. in 1900 and Heidelberg in 1903 bestowed upon him the degree of Ph.D. The German Emperor conferred upon him in 1911 the order Pour le Merite with the rank of knight, thus indicating the high appreciation with which his work is regarded by the savants of Germany.



Prof. Edward Charles Pickering.

President of the American Association for the Advancement of Science.

His elections to scientific academies have been numerous. In 1873 he was chosen to membership in the National Academy of Sciences, and he has long been a fellow of the American Academy of Arts and Sciences (vice-president in 1877) and a member of the American Philosophical Society since 1896 (vice-president in 1909). He also holds honorary or corresponding connections with the Royal Society of London, the Royal Astronomical Society and of the great academies of sciences in St. Petersburg, Berlin, and Rome, as well as of many other less well known.

He was elected to the American Association for the Advancement of Science at its Salem meeting in 1869 and was advanced to the grade of fellow in 1875. His affiliations have always been with the sections devoted to mathematics and astronomy, and physics. He was chosen to preside over the section on the physical sciences in 1877, and at that meeting presented an address on the Endowment of Research. No astronomer has been called to fill the high office of president of the American Association since 1893, when the late William Harkness held that important office. At the meeting held in Washington a year ago, when the claims of astronomers were considered, the candidate who at once commanded the recognition of his colleagues by his distinction in his chosen science, was Prof. Pickering, who was then unanimously chosen to preside at the Cleveland meeting, which will be held during the present week.

A Demonstration of Forestry Erosion Processes

By Stephen Byrd

EXPERTS of the Government have been successful in the construction of a striking working model showing the processes of erosion on deforested slopes. It is for the use of pupils in public schools who are taking courses in nature study, elementary agriculture and physical geography.

The model, about seven feet square, consists of two hills sloping down into two valleys through which two streams wind in and out through farm land and lead into two lakes at the front of the landscape. Both hills are made of the same kind of soil, but one is covered thickly with twigs, young trees, or shrubs, to simulate a forest, underneath which is a heavy carpet of moss representing the layer of leaves and twigs which covers the ground in the real forest, while the other hill is bare of all vegetation.

By means of a suitable sprinkling device on the ends of a "T" about 1½ feet above the crests of the hills, water in the form of rain is made to fall with equal force upon the two hills. On the forested slope its fall is broken by the foliage and it drops gently upon the moss-covered surface of the ground. The moss and the soil beneath, which is kept soft and porous by the protective cover, quickly absorb the "rain" and allow it to seep out as clear water farther down the slope, thus forming a mountain stream which flows through a green and fertile valley into a clear lake at the lower end of the model.

On the other slope the "rain" beating down upon the unprotected and hardened surface washes deep gullies in the hillside, carries the soil into the turbid stream which drains the valley below, and thence into a muddy lake. The erosion on the slope loosens stones, which are carried down upon the valley farms; the silt deposited in the channel of the stream diverts the water, which opens up gullies through the dry land; the main stream is made shallower and wider and often overflowers into the fields; island and silt bars rise in the stream; and deltas are built up in characteristic form at the entrance to the lake.

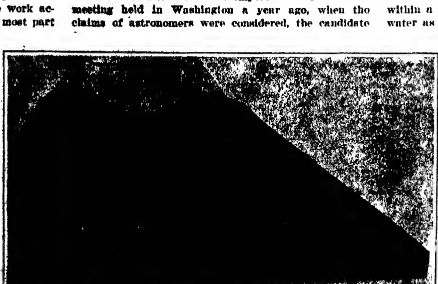
The erosion processes which work themselves out in the model, the wearing down of the hill, the silting up of the stream bed, the gradual shifting of the course of the stream, the formation of deltas and sand bars in the lake, and the gradual opening up of water-courses through them are all typical of the processes constantly going on in nature and show strikingly the close relationship between forests and surface formation. It is the same process of erosion on a larger scale which, after the destruction of our forests, causes the removal of the top soil from our slopes, cuts them up into gullies, and deposits sand and gravel upon the fertile alluvial soil of the bottom lands, in storage reservoirs, or in the channels of streams, where it impedes navigation and causes overflow.

While the model is not intended primarily to show more than the erosion processes, it can be used to show also that a forest-covered slope acts as a reservoir in impounding the water and allowing it to seep slowly into the streams, and, on the other hand, that water runs off the surface of a bare slope as soon as it falls, resulting in floods when the precipitation is heavy and in droughts during a dry season. If the sprinkler is stopped and all the water taken out of both of the stream and the lakes, the lake on the forest side will, within a few hours, receive a considerable amount of water as seepage from the wooded hillside, while the other lake will remain practically empty.

When the water is first turned on, that which comes from the forested hill will be slightly muddy, but will clear after running for a few minutes, and the mud will soon settle. Erosion will set in upon the deforested hill and the land below in a few hours.

In some of the models white sand and pebbles and small goldfish or turtles in the clear lake, have added a touch of realism and brought out the clearness of the water. Other ideas to add to the picturesqueness and instructiveness of the model have also been evolved, such as a road running through the fields, bridges across the streams, and a little farm house or barn appropriately placed. The bridge across the muddy stream is represented as damaged by floods, and the road on that side of the model muddy and deeply furrowed. In the construction of

(Concluded on page 560)



Working model for demonstrating to pupils in public schools, the processes of erosion on deforested slopes.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A New Aluminium Level

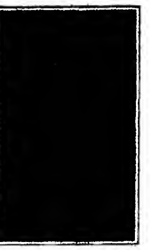
A LEVEL has recently been placed on the market made of aluminium, which for a metal level is light, as well as strong and durable. It will not warp, and with ordinary care will last a lifetime, not being affected by either dampness or heat.

It is doubly constructed; that is, it has two plumbs and two levels, so that no matter in what position it is picked up, it is always ready for use and can be used either end or edge up. The illustrations show it in use with the eye of the mechanic both above and below it. Plumbing can also be done with the eye above or below the spirit glasses.

There are two wires around each spirit glass, so that the position of the bulb can instantly be seen. The spirit glasses are securely set and cannot move or be jarred out of place. They are also guarded by heavy lenses set in the circular openings of the level frame to make the spirit glasses dust, dirt and water proof.

For the use of carpenters, millwrights, cement workers and plasterers the level is made in lengths of 3 feet 6 inches, 24 and 30 inches. Those designed for the use of machinists and others desiring shorter levels, are made 12 inches and 18 inches long.

Using the aluminium level horizontally.



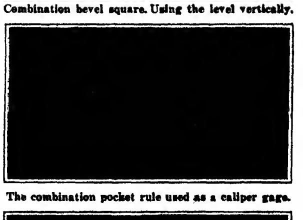
Combination bevel square. Using the level vertically.

A Combination Bevel Square

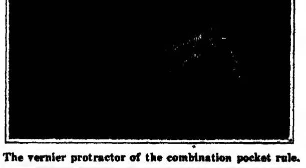
A SQUARE has been produced which combines a bevel square, divider and pencil compass, and measures ten inches over all when folded. The stock is formed with flanges on both sides, and the adjustable blade folds between the sides of the stock. In scribing angles from narrow flutes, or grooves, the operator can insert the flange of the stock in the groove and work from the face of the bevel. The square can be set with the pointed ends at any desired distance apart. Thus it is converted into a good divider. When used in the same form, with a pencil inserted in the holder at the outer end of the stock, it becomes an excellent pencil compass.

A Combination Pocket Rule

THE six-inch folding pocket rule, two views of which are given in the accompanying illustrations, is made of spring German silver and distinctly graduated. It can be used as a hook rule, caliper gage, protractor, triangle or try-square. The upper edge is graduated in thirty-seconds; the lower edge in sixteenths. The caliper blade is graduated in sixteenths on one side and thirty-seconds on the other. The protractor is divided to five degrees and the vernier reads to one half a degree. This rule can be set to any desired angle, and the center joint is so constructed that the rule remains firm wherever set. The protractor is divided into lines, each representing five degrees. The ten parts on the vernier correspond with the nine parts on the protractor. Consequently, each division on the vernier is smaller than each division on the protractor by one half degree. To read the distance the rule is opened and the number of lines on the protractor that have been moved from the zero point is first noted. Upon the vernier the number of divisions is then counted until one is found which coincides with one on the protractor, which will be the number of degrees or half degrees to be added to the distance read off on the protractor.



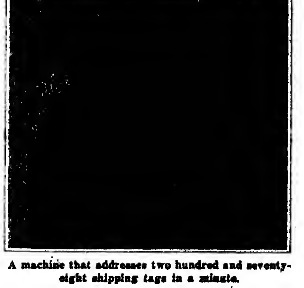
The combination pocket rule used as a caliper gage.



The vernier protractor of the combination pocket rule.

A Machine That Addresses Tags

A FEW years ago it was discovered in one of the large fertilizer companies in this country that during the busy shipping season of six weeks or more, it took every clerk in the office and everyone in the establishment, who could write with a pen and ink, six weeks or more to address shipping tags. By the time the shipping season was over, the work of everybody connected with the office force was so far behind that it took until the next busy shipping season to catch up. This led to the invention of the tag addressing machine. To-day, in that same establishment, the tag addressing machine, the first one ever produced, stands on the end of a long table in the basement. It is operated by a boy, who addresses all the tags required in the shipping department of the fertilizer company referred to. In spite of the fact that the business has increased wonderfully from what it was five years ago, when the tag addressing machine was installed, the boy has plenty of time to devote to other duties. At a test recently, the boy in one minute addressed two hundred and seventy-eight shipping tags, including setting up the name and address. In two seconds or thereabout the type wheels of the machine were returned to neutral and he was ready for another name and address.



A machine that addresses two hundred and seventy-eight shipping tags in a minute.

The tags for use in the tag addressing machine are automatically fed up into and through the machine in a strip from the storage bin in the cabinet, the tags being separated by a cut across to within 3/16 inch on each end.

The business card is printed from an electrotype attached to and made part of the machine.

The consignee's name and address is printed by type wheels, being adjusted by means of levers. A dial is set for the number of tags required for shipment and is automatically cleared when the number indicated has been printed.

There are no loose types in this machine and no stencils or plates, the type wheels being governed by a name lever and an address lever. An automatic counting device on the machine absolutely controls the number of tags printed, locking and cutting off the tags when the number indicated on the dial are addressed.

The machine is built to take a Standard No. 5 tag or record card as well as a very thin paster, which can be attached to cartons or boxes by means of paste or fasteners as the requirements of the shipper may warrant.

The machine prints the name and address of the consignee and such other information as may be desired.

The automatic counting device does away entirely with the possibility of loss through undershipments or overshipments, as the machine will produce exactly the number of addressed tags indicated in each instance.

Prize Offered for a Test to Detect Flaws in Autogenous Welds

THERE is at the present day one obstacle in the way of a more general adoption of autogenous welding of metal constructions which in use are subjected to considerable strains, and the rupture of which would endanger human life and property. This obstacle resides in the fact that no process is known by which the quality of the finished weld can be tested. Experiments have shown that the first condition to be fulfilled if the weld is to be sound, is that inclusions, large or small, must be avoided, and that the material does not become overheated in the process of welding.

The Central Bureau for Acetylene and Autogenous Metal Working in Nürnberg, with a view to perfecting the autogenous welding processes, has decided to offer prizes of an aggregate of 1,500 marks ($375) for the successful treatment of the problem stated below. The Carbidhandelsgesellschaft m. b. H. has generously furnished the requisite funds.

Problem: How can slag inclusions and unsound places, as well as flaws due to overheating, be detected in an autogenous weld, without injuring the weld in the process of testing?

In adjudicating the prize, special merit will be assigned to processes which make use of simple, readily transportable apparatus. It should also be noted that prizes may also be awarded to the originators of such processes as furnish a means of judging the quality of a weld satisfactorily in a majority of cases, without necessarily representing a complete solution of the problem.

The thesis must be submitted in writing, and must be identified by a motto, the name of the competitor to be filed in a sealed envelope, together with the motto appearing on the thesis. Entries must be completed on or before July 1st, 1913, and sent to the address appearing at the end of this announcement.

The jury will consist of the following gentlemen:

Geh. Regierungsrat Prof. Dr. Ing. Dr. F. Wüst, president of the Iron Institute of Aachen.

Prof. Dr. Ing. G. Schlesinger, president of the Mechanical Engineering Experiment Station at the Technical University of Charlottenburg.

Prof. R. Baumann, director of the Bureau for Testing Materials of the Technical University of Stuttgart.

Ingenieur Hermann Richter, professor at the Technical Professional Schools of Hamburg.

Karl Schröder, chief engineer of the Railway Supplies Company of Upper Silesia.

One representative of the undersigned Büro.

The prizes are awarded by the jury.

The first prize will be 1,000 marks ($250); the second, 500 marks ($125).

The thesis for which the prize is awarded will be published without compensation.

(Signed) Zentralbüro für Acetylen und Autogene Metallbearbeitung, Nürnberg, Gugelstr. 54.

Invention Versus Aggregation

In a recent case in the United States District Court, Southern District of New York, Mr. Justice Mayer, District Judge, in his decision, the invention being a water heater, pointed out that prior to the invention of the patent in suit, the art of automatic instantaneous water heating had developed along two main lines: (a) the "straight water valve" heater and (b) the "straight thermostatic" heater. He proceeded to point out the defects in both (a) and (b) forms of heater, and that while one was not a commercial success, the success of the other was limited to natural gas territory, because of the large cost of operation in artificial gas territory, and said:

"The problem to be solved and here claimed to have been solved was to produce an instantaneous, automatic water heater which would (1) be safe; (2) be economical; (3) heat the water to a desired predetermined temperature, and (4) proportion gas consumed to amount of hot water drawn, even in localities where gas and water main pressures fluctuate.

"This was an interesting problem having to do with an important and useful art which has much conduced to health and comfort.

"Ruud was an experienced man who had already made contributions to the art, and he was able, therefore, to approach the consideration of this problem in a practical way. He was not searching for a theory, but for an operative structure, and there can be no doubt that he produced an efficient and highly useful article in the "T. V." heater, as it is called.

"From the outset, this T. V. heater became a commercial success, so much so that the Monarch Company, a competitor, adopted the Ruud invention at a time when the patent application was pending and when letters had not yet been issued."

He then asks:

"Was there inventive genius behind this production or was it obvious to the man skilled in the art and a mere aggregation of old elements and not a combination attaining a new result?"

The object of the invention set forth in the patent in suit is stated in the patent itself to be:

"To provide effective and reliable means whereby waste of gas, during periods in which it is not desired to heat water, may be prevented, and liability to damage to the heating appliance or its connections, by the application of heat in the absence of a proper supply of water, or by the excessive application of heat when water is not drawn off from the heater, due to the sticking of the water valve mechanism, may be effectually obviated." (Page 1, lines 21 *et seq.*)

To accomplish these objects, Ruud introduced into the gas service conduit a gas supply valve and a gas regulating valve, by which two valves the supply of gas to the main burners is controlled and regulated.

"The main or water actuated gas valve is always thrown wide open, and is of sufficient size to admit enough gas to heat the water to the desired temperature at the highest water main pressure, and the lowest gas main pressure. With the high water main pressure a larger amount of water would flow through the heater, per unit of time, than with the low water main pressure, and if the supply of gas were constant the result would be that the water would be heated to a higher degree at a low water main pressure than at a high water main pressure.

"When the water in the heater reaches the degree of temperature to which the thermostat is adjusted, the thermostat immediately begins to actuate the thermostatic valve to reduce the size of the opening controlled thereby, and hence to reduce the amount of gas which flows to the burner. Should the gas pressure be high, more gas is supplied than is needed to heat the water to the desired temperature, and the thermostat operates to cut down the amount of gas until just enough is supplied to heat the water flowing through the conduit to the temperature desired. Should the pressure in the gas main fall, the temperature of the water would fall, and this would act to open the thermostatic valve wider so as still to permit enough gas to flow to the burners to heat the water to the desired temperature.

"Thus the water is heated to the desired temperature, whether a large or small amount of water within the capacity of the heater is being drawn, and the supply of gas to the burners is regulated to suit the amount of water heated, and this entirely independent of what may be the water main or gas main pressure at the instant of time when water is being drawn; and if no water is being drawn the flow of gas to the burners is entirely cut off by the water actuated or main gas valve.

"It is old in the art to employ the movements of a part actuated by the flow of the water through the heater to control the flow of gas to the burners of the heater; and it was also old to employ the movements of a heat actuated element to control the flow of gas to the burners. These old elements had been separately used in heaters to control the flow of fuel to the burners, but Ruud, for the first time (it is claimed), combined the two elements in a single heater.

"I am satisfied on the evidence, that this combination produced a result which was not an aggregation of old elements, each merely performing an old and well known function and not bringing about a new result. If I am right in concluding that the new result, insisted upon by complainant, was accomplished by the combination of these old elements, then it seems to me that the case is one of invention.

"Of course, it is very easy at this date, to see how it was done; but this is an active art, attractive financially and constantly inviting improvement, and if invention was not involved it seems strange that no one had disclosed, prior to this time, any structure which represented what is embodied in the Ruud or T. V. heater.

"In his ingenious argument that certain of these patents accomplished by a short arm what Ruud accomplished by a long arm, the learned counsel for defendant failed to make clear how what was obvious (as he urged) so successfully escaped the attention of these many inventors whose minds were moving along in the same general direction."

Notes for Inventors

A Novel Trajectory Regulator for Projectiles.—Cleland Davis, U. S. Navy, has patented, No. 1,043,074, a trajectory regulator in which there is combined with the projectile, plates which are mounted therein and move radially through centrifugal force to regulate the trajectory, and electric controlling means are provided which govern the extent of the outward movement of the plates.

A Power-operated Coupon Cutter.—A power-operated cutter to clip coupons is shown in the patent, No. 1,042,436, to Garret A. Hobart of Paterson, N. J. It is an electrically operated machine supplied with a knife-carrier pivotally supported at one end with a knife at its other end and an oscillating lever which is operatively connected with the knife-carrier and is operated through a suitable plunger by a solenoid.

"Sandwich Paper," a New Paper Product.—A French paper, devoted to paper manufactures, tells of a new paper product said to have been invented in Germany. It consists of two thin sheets of paper pulp between which is arranged a sheet of cotton or similar cloth with which the pulp layers are so thoroughly incorporated as to form practically an integral and compact sheet. It has been aptly called a sandwich paper and is adapted to a variety of uses.

A Sliding Pad for Baseball Players.—Frederick C. Clarke of Winfield, Kan., assignor to A. G. Spalding & Bros., Jersey City, has patented, No. 1,044,094, a sliding pad which is detachably secured to a garment and extends around the greater portion thereof. The pad is generally rectangular in outline and a loose lining is secured only at its edges to the pad, the pad being especially designed for use in sliding to bases.

Mixing Oil and Gasoline.—We are told that the fishermen off the coast of Maine, using motor boats, feed the lubricating oil to the cylinder with the charges of gasoline and dispense entirely with the lubricating cups on the cylinders. In this way they avoid the care of the cup and are sure the oil is feeding so long as the gasoline supply is maintained. Ordinarily, about one pint of oil is mixed with five gallons of gasoline. The only objection suggested to the practice is that the carbureter becomes foul and must be cleaned oftener than otherwise; but this is more than balanced by the freedom from worry about the feeding of the oil.

A Stocking With Two Feet.—With a woman's appreciation of economy, Emma C. Parsons of Somerville, Mass., shows in a patent, No. 1,044,587, a stocking which has a leg portion with a foot portion at each end. In describing the stocking, it is said to have a foot portion at one end of the leg and having at the opposite end of the leg and on the forward side thereof a fullness adapted to receive the knee of the wearer with an extension on the opposite side, the fullness and extension constituting the heel and toe of a reserve foot portion, it being the intention to wear out one foot portion and then the other, so that the leg of the stocking will do double service.

The End of Human Improvement.—In his report of the operations of the Patent Office during the year 1843, Henry L. Ellsworth, the then Commissioner of Patents, called attention to the whole number of patents issued by the United States up to January, 1844, as being thirteen thousand five hundred and twenty-three, and to five hundred and thirty-one of these patents having been granted in 1843, being an increase of twenty-four over the previous year. Then, apparently appalled by the great development and perfection of all the arts, the honorable Commissioner suggests the completion of invention at some early day in the following words embodied in his official report: "The advancement of the arts, from year to year, taxes our credulity and seems to presage the arrival of that period when human improvement must end."

Safeguarding the Operator.—In connection with a punch press or similar machine having a dangerous part, the operation of which is periodic, Frank C. Spencer of Chicago, Ill., provides in a patent, No. 1,043,876, a protective means which is actuated automatically in accordance with the periodic operation of the dangerous part and includes a gate which moves from one side of the operator's arms and transversely thereto into position in front of the dangerous part so that the operator's hands will be pushed away from the dangerous part as the gate moves into operative position.

A Life-saving Garment for Aviators.—The garment shown in patent, No. 1,042,327, to Joseph J. Costanzo of Alexandria, Egypt, is made with a number of concentric inflatable members adapted to be positioned around the body and collectively form a covering for the body, each of the members comprising a plurality of inflatable chambers and means are provided for holding the chambers in each member together.

Some Adjudicated Patents.—Among the adjudicated patents reported in recent issues of the *Patent Office Official Gazette*, are The Loesser & Loesser patent, No. 573,672, for a diamond polishing "dope," which was held invalid in American Patent Diamond Dop Company v. Wood; the Fessenden patent, No. 706,736, for apparatus for wireless telegraphy which was held not infringed in United Wireless Telegraph Company v. National Electric Signalling Company; the Parsons' patent, No. 723,299, for an armor for pneumatic tires which was held valid and infringed in Parsons Non Skid Company v. Atlas Chain Company and the Wood patent, No. 839,356, for a process of dividing diamonds which was held invalid in Wood v. Kahn.

Legal Notes

An Adjudicated Patent.—In the case of the Gilbert Manufacturing Company v. Post & Lester Company, 197 Fed. Rep., 56, the Bowers' patent, No. 872,892, for a spare tire holder for automobiles was held void for lack of invention.

Revision of Patent Law.—It is reported that the chairman of the House Committee on Patents, Mr. Oldfield, intends to demand action upon his recodification bill which was introduced during the latter portion of the last Congressional session and that he has called a meeting of his committee to take under consideration the steps necessary to secure the legislation he desires. It is probable that a unanimous report will support the recommendations of the committee. An object of Mr. Oldfield's bill is to secure the prohibition of price fixing by the patentees of the patented products and also to prevent the control of the supplies used in connection with the apparatus covered by the patents.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT CLASP.—M. KRISCHER, 14 Lewis St., New York, N Y This clasp includes a loop and a tab carrying a button, and the object of the inventor is to provide an improved means for securing the tab and to combine the tab with the buckle from which the loop and the tab are suspended in a novel manner. The clasp is more especially intended for use as a stocking supporter

GARMENT POCKET.—T J CAHILL, Hotel Maywood, Corning, Cal This improvement is in pockets for men's outer garments, and has particular reference to the construction of a pocket whereby foreign matter such as dust, water or the like may pass through the bottom thereof and escape, without destroying the usual functions of the pockets.

HOSE SUPPORTER.—NORMA F SCHAFUSS, 47 Brevoort Place, Brooklyn, N Y This invention prevents tearing or ripping of the hose and allows of perfect freedom of limbs, especially at the knees. Use is made of a band having converging members, the terminals of which are provided with means for connection with the upper edge of the hose on opposite sides thereof, and supporting straps for the said band and connected therewith at the outer terminals and at the joint of the converging band members

Of Interest to Farmers.

CULTIVATOR.—R. H PURNELL, Rosedale, Miss This invention provides a main draft beam with two attachments, one a supplemental pivoted beam carrying a scraper or other cultivating device to swing laterally, to vary the lateral angle of the scraper; the other is a runner and gage arranged in rear of the supplemental beam and adapted for vertical adjustment, to vary the depth at which the scraper or other tool shall enter the soil

MILK PAIL COVER.—W. A. METZGER, care of W H Montgomery, Red Hook, N. Y This invention provides a structure to thoroughly cover the pail, but prevent any foreign or extraneous matter from entering during milking. It provides a cover for use during milking which will permit the milk freely to flow into the pail, but which will prevent or minimize the splashing of milk.

CORN PLANTER.—M H. W., 1422 Franklin Ave, Lexington, Mo This invention provides a driving mechanism for the dropper operable by the carrying wheels of the planter, which may be regulated as to the initial operation to place the seeds in parallel arrangement in a planted field; and provides a driving mechanism which is simple, and at all times under control

DISK PLOW AND BEAM THEREFOR.—A. N MCKELLIPS, R. F. D No 2, Billings, Mont. In the present patent the invention has reference to disk plows, and it has for its purpose the provision of one with a beam having a curved end, and disposed around and secured to a bearing, in which is journaled a stud secured to and projecting from a disk

Of General Interest.

TOILET POWDER DISPENSER.—E. OLDENBAUSCH, care of Kronheimer & Oldenbusch, 866 Butler St., Brooklyn, N. Y. A movable closure is automatically operated by pressure to release a portion of the contents of the container, and is automatically closed after pressure thereon is relieved, and combines with such automatic closure, means whereby its opening movement is limited so that accidental displacement and disconnection between the closure and the container is prevented.

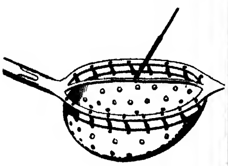
PROJECTILE AND METHOD OF FIRING THE SAME.—R POMPILI, Villino Arnaldi, Tivoli, Italy. The invention has for its object to do away with the cumbersome and heavy gun barrel by utilizing the combined action of the high explosives, and of the resistance or inertia of the air In high mountains the invention enables artillery to reach places not approachable up till now; it avoids many difficulties of transporting heavy guns and allows of the locality being quickly abandoned and moving the heavy pieces and gun carriages Still more important is the use of the method on board of dirigible airships in which it is impracticable to carry pieces of ordnance It is not only useful for fighting against other dirigible airships, viz., for firing projectiles in horizontal directions, but also downward. The method can be also used for throwing safety ropes to ships and in other similar cases.

RIFLE WIPE ROD.—J HURST, care of C. L Odell, 213½ 19th St, Bessemer, Ala The wipe-rod or wipe-stick proper is so attached to a tubular handle as to adapt it to rotate, and also to be quickly clamped in the handle when required A series of wipe-rods may be employed with one and the same handle, and each of them will have, in practice, a terminal portion. Thus it will only be necessary to provide plugs which have a bore that receives the particular wipe-stick that may be inserted in the handle.

ARTIFICIAL LIMB.—U. HOKE, Cornwall,

Pa. This invention provides a device of the peg leg type arranged for permitting the peg to stand in alinement with the axis of the stump socket, or at an angle thereto, wherein means is provided for locking the parts in alinement, capable of being easily locked or released through the clothing which will hold the parts in rigid alinement when in locked position.

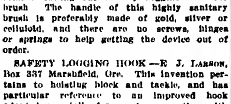
BUCKET.—C. H. Gibson and T. Creeds, Box 833 Wenatchee, Wash. This invention is especially adapted for use with the dredging apparatus in these inventors co-pending application, serial No 677,697. It is for prospectors use the production cost is low and is one that is not easily deranged, thereby providing for continued and efficient use in places where very extensive repairs are not possible. It is primarily designed to run along the gravel beds or sandy bottoms of streams with the pointed end foremost, the actual movement of the bracket being provided through suitable means on which a certain cable or chain or rope is wound, the guiding of the bucket being



DREDGING BUCKET.

attended to by an operator through the medium of the handle seen in the illustration. This form of bucket is in use on their dredger now working in some of the most inaccessible places in Alaska and the Northwest.

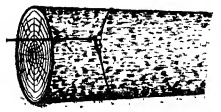
AN ADJUSTABLE SANITARY HAIR AND TOOTH BRUSH.—A. L. Holtzman, 192 Central Ave, East Orange, N J. This inventor provides a hair or tooth brush, as shown in the illustration, supplied with a removable bristle holder to permit of replacing the same when the bristles are worn out and thus allow the use of a single expensive brush handle with a number of bristle holders for a very long period at a nominal price. For this



ADJUSTABLE TOOTH BRUSH.

purpose, use is made of a handle having a seat for the reception of a bristle holder, and means for removably securing the bristle holder on the seat. It is adapted to be made in any shape especially for tooth brushes and hair brushes. The back of the bristles are set in rubber, which insures against any bristles falling out or any sogginess of the brush. The handle of this highly sanitary brush is preferably made of gold, silver or celluloid, and there are no screws, hinges or springs to help getting the device out of order.

SAFETY LOGGING HOOK.—E. J. Larson, Box 337 Marshfield, Ore. This invention pertains to hoisting block and tackle, and has particular reference to an improved hook adapted especially for use in connection with a draft cable, such as is used for instance in logging camps or like places where heavy ob-



SAFETY LOGGING HOOK.

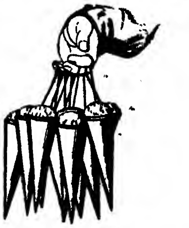
jects are being drawn by distant power. The invention specifically covers certain details of construction embodying elements of cheap ness, maximum strength and highest efficiency and safety during operation. The cable is passed around a log as shown in the engraving, where it is represented in operative position.

COLLAPSIBLE TUBE.—C. H. Stuart, Newark, N. Y. The intention here is to provide a tube having an outlet neck, and a closure therefor, so formed and arranged that the closure will have a tight fit at all times in the outlet orifice of the neck, and will not become loosened by repeated insertion and removal.

PIPE COUPLING.—E. L. Blood, Mulberry, Fla. This invention comprehends more particularly a flexible coupling especially adapted for use on the suction and discharge sides of pumping devices in order to relieve the pipe line of vibration. It is also adapted for use as a flexible connection in any hydraulic line, pumping water or water and other substances.

TURPENTINE CUP.—W. O. Daly and L. Lerio, care of Lerio Turpentine Cup Co., Mobile, Ala. The inventors provide a construction whereby the cup can be easily applied, be securely held in position when applied and can be easily removed and reapplied when desired. To this end they provide in connection with the cup proper bearing devices above and below the cup and having interlocked engagement with the cup so that the cup when applied in connection with these bearings will be securely clamped in position.

HOLDER FOR ICE CREAM CONES.—J. Renner, P. O. Box 238, Rockwell City, Iowa. The aim in this invention is to provide a hold-



HOLDER FOR ICE CREAM CONES.

er for ice cream cones, which may be manufactured at little expense, and which makes it possible for one person to carry and distribute a great number of ice cream cones at one time, without it being necessary for him to touch the ice cream cones or to soil them. In this way the cream cones may be carried about by any person without danger of their becoming soiled or dirty and also of not being so liable to melt as quickly as by other methods of handling. The engraving shows how a large number of the cones are carried. This invention is for sale outright, or may be manufactured on a royalty basis.

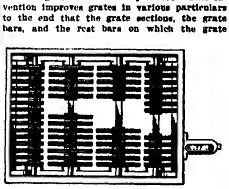
DIAMOND HOLDER.—F. W. Bauscher, 477 Canal St., N. Y., N. Y. This device holds diamonds and other gems when they are to be worked and polished and it comprises a base so mounted that it can be moved into any position for the operator, and it is provided with means for holding the gem securely in place until the operation of polishing is finished.

Hardware and Tools.

HAND STAMP.—H. Neumann and A. Dorner, 552 W 120th St., Manhattan, N. Y., N. Y. The aim of this invention is to provide a stamping device more especially designed for stamping hams and other meats or other articles, and arranged to permit the operator to conveniently handle the device so as to stamp a large number of articles in a comparatively short time.

Heating and Lighting.

FURNACE GRATE.—M. E. Hansell, P. O. Box 3, Anamosa, Iowa. This invention is intended more particularly for embodiment in the grates of steam boiler furnaces, and it relates to that type of grate in which removable grate sections are provided. This invention improves grates in various particulars to the end that the grate sections, the grate bars, and the rest bars on which the grate



FURNACE GRATE.

bars are removably supported, may be conveniently removed and renewed when desired, and it minimizes the possibility of clinkers causing the breakage of grate sections in the rocking of grate elements. The engraving shows a plan view with some of the grate sections removed.

Household Utilities.

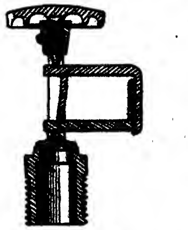
ATTACHMENT FOR BEDS.—J. G. Laycock, Box 107, Russellville, Ohio. This invention has reference to attachments for beds, and more particularly it is directed to an improved construction especially adapted for use in hospitals or for the use of invalids generally whereby such persons may assume a sitting posture when so desired.

COMBINED CURTAIN ROD AND SHADE FIXTURE.—C. W. Sumner, 819 7th St., St. Petersburg, Fla. This improvement provides a device for supporting a curtain and a blind roller, which consists of few parts, is [illegible] of being adjusted to fit any [illegible] adjusted vertically on the [illegible] means adjustable on the [illegible] the blind roller.

VALVE.—A. B. Uhler, 943 Ross St., Springfield, Mo. This improvement has for its purpose the provision of a simple valve for use with flushing tanks for controlling the [illegible] for controlling the flow of water to the tank, wherein means is provided for quickly closing the valve at the proper time, regardless of the water pressure.

Machines and Mechanical Devices.

AUTOMATIC SPRINKLER VALVE.—L. A. Grimes, 205 Windsor Place, Brooklyn, N. Y. The invention relates to a valve where the



AUTOMATIC SPRINKLER VALVE.

water outlet is opened when subjected to influence of abnormal temperature. The operation depends upon the melting of some fusible metal, but in present devices the separation of metals held by the fusible solder, takes place either in a V movement, a sliding movement, or their combination. It is an object of this invention to eliminate the possibility of cold flow, by constructing the two parts so as to separate bodily one from the other and thereby utilizes the whole area of adhesion afforded by the soft solder. The engraving herewith shows a vertical transverse sectional view of the invention.

RECTIFYING DEVICE.—J. H. W. Knoop, care of Phila. Inquirer, 1109 Market St., 6th floor, Phila., Pa. This improvement relates to rules in tabular and similar matters produced by line or type producing machines, and its object is to provide a new rectifying device to enable an operator to bring into perfect alinement the rules of such tabular matter.

Prime Movers and Their Accessories.

STEAM ENGINE.—M. A. Green, 643 Real Estate Trust Bldg., Philadelphia, Pa. The purpose here is the provision of simple, economical and easily operated means for varying the clearance of each end of the cylinder in order to increase or diminish the compression and without affecting the total length of the cylinder or total length of the piston.

Designs.

DESIGN FOR A HANDLE OF SCISSORS-BLADES.—W. M. Bowen, care of Clayton Bros., 127 Duane St., New York, N. Y. In this case the design of a handle of scissors blades shows a result pleasing in form with an ornamental feature on the inner edge of marked originality.

DESIGN FOR A DOLL.—Edith M. Mines, Colville, Wash. In this design for a doll a small girl stands with arms outstretched and is clothed in a dress whose ornamental features comprise squares dotted over the whole, these squares being spread also over the hair, face and feet, and producing an extremely original and effective article.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We are prepared to render opinions as to validity or infringement of patents, or with regard to conflicts arising in trade-mark and unfair competition matters.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

Munn & Co.,
Patent Attorneys,
361 Broadway,
New York, N. Y.

Branch Office:
625 F Street, N. W.,
Washington, D. C.

INQUIRY COLUMN

Inquiry No. 9287. Wanted to buy a machine which will reduce cobs to meal—not a machine for shredding the cobs, but a machine that will pulverize them.

Inquiry No. 9288. Wanted the names and addresses of concerns that can [illegible] balls [illegible] the one-sixteenth of an inch [illegible].

Inquiry No. 9289. Wanted [illegible] and [illegible] when [illegible] any flavor to tobacco smoke and without [illegible] any oil or fatty vapor.

Inquiry No. 9290. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292. Wanted a glue that will stick labels to grape-fruit.

Inquiry No. 9293. Wanted the names and addresses of manufacturers of [illegible] samples of each [illegible].

Inquiry No. 9294. Wanted the [illegible] in diameter.

Janeway's Insufflation Apparatus

(Concluded from page [illegible].)

up the trachea and out through the larynx and mouth in a continuous stream shall have free escape. Later it was found of advantage to interrupt the stream from three to six times a minute, to allow the lung to collapse for a moment at times, and thus to get rid of the small quantities of carbon dioxide (the gas normally excreted from the body by exhalation) which are apt to remain in the pulmonary alveoli.

We may no longer pursue this fairy tale of science, in which appear such illustrious names of physicians, surgeons and physicists as von Mikulicz, Sauerbruch, Fell, O'Dwyer, Matas, Kuhn, Volhard, Hirsch, Sollman Robinson, Elsberg, Carrel, and others, except to observe that the thoracic region, formerly a *noli me tangere*, is now freely entered, and that many conditions formerly inoperable, from which patients had to die unrelieved, are to-day successfully coped with. Such are asphyxiation by drugs, smoke or immersion in water and such lesions as tuberculosis, abscess and gangrene of the lung; while the gullet, the aorta, the cardiac end of the stomach and so forth, can be reached with impunity.

We have now to describe the *insufflation apparatus for intratracheal anesthesia* devised (on the principles set forth) by Dr. H. H. Janeway. This is a portable apparatus for administering ether, capable of accurately gaging the supply of the latter, its dilution with warmed filtered air, and with mechanism for carefully regulating pressure and temperature. There is an electro-motor running on direct or alternating 110-volt current, the speed of which is adjustable by means of a rheostat. A positive pressure blower is connected to the motor's shaft, and has at its other end a worm gear which regulates the periods of rhythmic inflations (inhalations and exhalations) by a specially constructed slide valve actuated by this worm gearing. The pressure of the blower may be varied at will from nothing to 90 millimeters (Hg) if desired, and the air thus compressed passes through a muffler and filter whereby all impurities and odors are removed, noise being thus avoided as well. The filtered air passes by a special valve either directly over the surface of the water in the water jar (which is heated by an electric heater) or it may first pass over the surface of the ether in the ether jar, or through both jars at the same time, thus providing a perfect mixture. The amount of ether is controlled by a specially constructed spiral tube valve, which admits the air directly at the surface of the fluid (at any level, according to the amount of ether used). A valve placed between the two jars controls the air to enter the water or ether jar, or both. From the jars a pipe leads the ether-laden air to the time valve and branches off midway to a *safety valve*, which may be set for any pressure and will blow off any excess; a manometer connected to the blow-off valve, by the difference in the mercury columns, shows the amount of pressure delivered to the patient. A small catch basin serves to prevent the accumulation of any moisture in the breathing tube, and thus only filtered warm air is admitted into the patient's mouth. The electric water heater acts almost instantaneously, and a rheostat is provided for keeping the temperature fixed at a certain degree, which may however be varied at will by the use of an electric current switch. The apparatus has a very wide range of application because of its variable speed and variable pressure. For intratracheal insufflation low pressure below 20 millimeters is appropriate; while high pressure may be used in connection with a small cabinet, resembling a negative and positive chamber—an air-tight compartment into which, through an encircling elastic collar, the head of the patient is thrust for etherizing. The complete large apparatus weighs 45 pounds, and is [illegible] by 13 by 10 inches for hospital use; a smaller apparatus weighing 25 pounds is designed for private use and

operates in a similar manner; both can easily be attached to a patient's bedside.

Forestry Erosion Processes

(Concluded from page [illegible].)

the model a tray from 4 to 7 feet square and 6 inches deep, having been at first waterproofed, is filled with 4 inches of rubble and earth, with the general slant of the surface toward the center of the front of the tray. Slight depressions are made as foundations for the two streams and for the two lakes. Over this is next placed 1 to 2 inches of mortar, consisting of one part cement and two parts sand. The stream beds and lake depressions are worked in before the mortar sets, taking care that the outlets of the lakes are only slightly lower than the intakes at the mouths of the streams. This cement, when dry, is waterproofed with hot paraffin, and a gutter is run along the front to receive the drippings of water as well as the runoff from the lakes. This water should empty into a waste pipe. In the rear of the model two mounds of earth, about 1½ feet high, should be placed, with a depression between them. One of the mounds is covered thickly with moss, and through this small twigs or trimmings of hedges should be stuck to represent a forest. Stretches of nearly level land should extend from the bases of the hills to the lakes. The land below the forested hill should be covered with rich soil and that part adjacent to the stream and lake covered with moss to prevent washing. The other section should be barren and strewn with stones and small boulders.

New Information on Forest Fires

THE subject of Forest Service Bulletin 117 has been strikingly brought to the public mind during the last few years by reason of the exceptional number of extensive forest fires, which have arisen both on private and on public lands. The fact that the fall of 1910 was one of exceptional drought in the western United States accounts for the prevalence of these fires, but they occur to a greater or less extent every year, and are a source of inestimable loss to the people of this country. The present is an opportune time for the discussion of this subject, partly because of the extent of this enormous loss, but more because public attention may now be easily attracted, inasmuch as the general reader has recently been able to see and to figure out for himself the causes and the damage occasioned by these fires.

Mr. Fred G. Plummer, the geographer of the Forest Service and author of this bulletin, has considered the subject under the following headings: Sources and Scope of Information; Ancient Fires; Causes of Fires; Smoke Phenomena of Forest Fires; Historic Fires; Statistics of Damage and Loss.

The report is based upon statistics received from every State and Territory in the Union and as far back as there are available records. Every bit of information was reduced to a common standard and a card system devised for use in future compilation of forest fire statistics. The figures given in the final table of forest fires in the United States, Canada and Newfoundland embrace a record of the causes and of the number of fires, total area burned, and the amount and value of timber consumed. Credit is given by the author to others who had previously gathered statistics on the subject, but Mr. Plummer has succeeded in bringing together the most complete record which is presented in the most compact and intelligent manner. The reader will be impressed with the great care and technical skill exhibited in the preparation of this new and real unique report. While the bulletin is necessarily technical in some parts, as for instance in the discussion which deals with smoke phenomena of forest fires, yet the non-technical reader will find a mass of data that will enable him to see for himself the great problem confronting the American people.

INDEX.

The * Indicates that the Article is Illustrated with Engravings.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12718) J. C. C. asks: If one marble be snapped horizontally from the top of a table, and another be dropped from the same height at the same instant, which reaches the floor first? Why? A. Sir Isaac Newton stated three laws of motion which from his time to the present have been universally accepted as true. The second law is "A given force produces the same effect, whether it acts upon a body at rest or in motion; whether it acts alone or together with other forces. You will see that the second part of this law covers the case of a ball dropped from a table and another ball shot horizontally from the same level at the same instant. The first ball falls by the force of gravity alone. The second ball has, as you say, two forces acting upon it. The ball obeys both forces at the same time. It falls as if gravity acted alone. It goes by the blow as if the blow acted alone. Both balls reach the floor at the same instant. Probably the high-school teacher of physics in your city can show you the experiment proving this fact. It is very easily made with simple apparatus. One method of performing it is described and illustrated in Hopkins's "Experimental Science," vol. 1, pages 43-44. This work upon experimental physics ought to be in every high school and village library We send the two volumes for $5 and shall be pleased to receive your order for the book.

(12719) F. L. B. asks: Will you please decide the following question: Is the Gulf Stream fresh or salt water? A. The water of the Gulf Stream is salt. It is ocean water which has coursed along the northern coast of South America, through the Caribbean Sea, into and around the Gulf of Mexico, and which emerges into the Atlantic Ocean between Key West and Cuba When it passes the peninsula of Yucatan into the Gulf of Mexico, its velocity is ¼ mile an hour, its width 90 miles, and its depth about 6,000 feet. When it passes into the Atlantic at Key West, its velocity is from 4 to 5 miles per hour, its width 50 miles, and its depth about 2,100 feet. Its high velocity is due to its crowding through this narrow and shallow channel. In the North Atlantic its velocity decreases rapidly, and off the banks of Newfoundland is less than half what it was when it passed the Straits of Florida It has been estimated that the Gulf Stream carries daily along the Florida coast the enormous quantity of 436,000,000,000,000 tons of water. Our figures are quoted from Tarr's "Physical Geography," price $1.55 postpaid.

(12720) R. J. C. asks: If the earth could be made smooth at the equator, so as to make a perfect circle, and a band of metal fastened to fit tight around the same, how far would the addition of 6 feet to the band make the same stand out from the surface of the earth? A. You will find the full solution and discussion of your problem in the SCIENTIFIC AMERICAN Query Column, Vol. 102, No. 25; Vol. 103, No. 3, and in Vol. 104, No. 7, price ten cents each. The answer is found by dividing the increase in the circumference, 6 feet, by 3.141592, and taking half of the result. Strange to say, the increase of the radius for the same increase of the circumference is the same for all circles of whatever size they may be. The answer in your case is 0.99 foot. Increase the circumference of any circle by 6 feet and the diameter is increased 1 98 + feet, and the radius 0.99 foot. This is because the circumference and radius of any circle have the same relation to each other, which is shown in geometry to be 3.1416 and is designated by the Greek letter π.

(12721) Will you tell me through your Notes and Queries column under the signature O. S.: Is it at all extraordinary or very uncommon to see one or more stars in the heavens about noon on a sunny day? What are the circumstances or conditions under which it is possible? A. For about five weeks preceding and following inferior conjunction, the planet Venus may be seen during the daytime in full sunlight, if one knows exactly where to look for the planet. This occurs every year, and is not extraordinary. 2. Will you tell me of a large work on astronomy, the very best that can be had on that subject, giving a clear idea of this science, without too much mathematics? A. The best book for a textbook of astronomy we are inclined to think is Young's "Manual of Astronomy," price $2.50. It is not a mathematical work, but descriptive.

(12722) T. P. B. asks: Do you think the apparatus constructed as per drawings inclosed would transmit and receive wireless messages? A. Our SUPPLEMENT No. 1363, price ten cents, describes and shows cuts of every part of a small wireless outfit with a coherer as the receiving instrument. We must say that we should not advise anyone to use a coherer, since it was long ago supplanted by the various crystal detectors, which are more cheaply and easily made. We do advise those who want to experiment and make their own wireless outfits to get our book, Morgan's "Wireless Telegraph Construction for the Amateurs," price $1.50, and follow the instructions in the making of the apparatus for their station. We should not advise you to build upon these drawings at all, although the outfit would work

THE TRUTH No. 3

The Interstate Commerce Commission at Washington, after two months' consideration of the accident at Westport, has recommended as follows:

"Railroads ought to unitedly experiment with the automatic train stop until a device of practicability for general use shall be available."

The accidents at Bridgeport in 1911 and at Westport in 1912 were exact duplicates. The engineers violated the rules of the road and passed all signals and warnings and went to their death carrying several passengers with them. Let us not blame them. Let us all co-operate to eliminate human error by mechanical device. The inventive genius of mankind has never yet paused before any public need. The need of the present, to more thoroughly safeguard life on even the best built and best equipped railroads, is that which the Interstate Commerce Commissioners recommend—an automatic train device that shall set the air brakes or close the steam throttle, or both, when a train fails to stop on signals.

The New York, New Haven & Hartford Railroad Co. hereby offers:

A REWARD OF $10,000 (coi) C

TO BE PAID ON THE ORDER OF THE INTERSTATE COMMERCE COMMISSIONERS AND THE RAILROAD COMMISSIONERS OF MASSACHUSETTS AND THE PUBLIC UTILITIES COMMISSIONERS OF CONNECTICUT, TO WHOEVER SHALL FIRST INVENT AN AUTOMATIC DEVICE THAT WILL SAFELY ARREST AN EXPRESS STEAM LOCOMOTIVE THAT HAS PASSED DANGER SIGNALS; THE TEST OF EFFICIENCY TO BE ITS ADOPTION WITHIN THE YEAR 1913, 1914 OR 1915 BY THE NEW HAVEN ROAD, THE NEW YORK CENTRAL, OR THE PENNSYLVANIA AND ITS APPROVAL OR RECOMMENDATION BY THE INTERSTATE COMMERCE COMMISSIONERS.

CHARLES S. MELLEN
President

Date of issue.	Date of issue.	Date of issue.